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METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS

VOL 98 No 5

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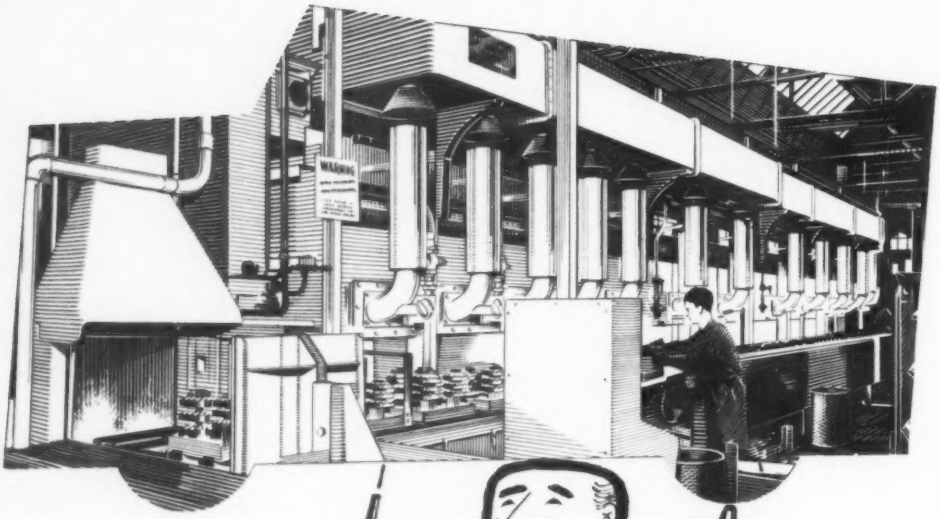

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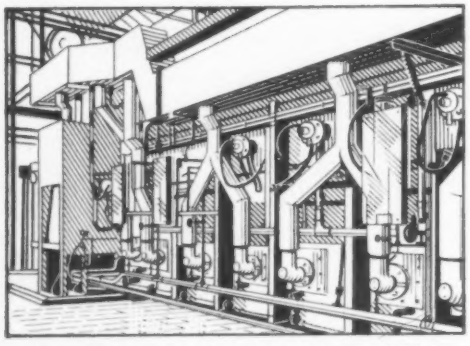

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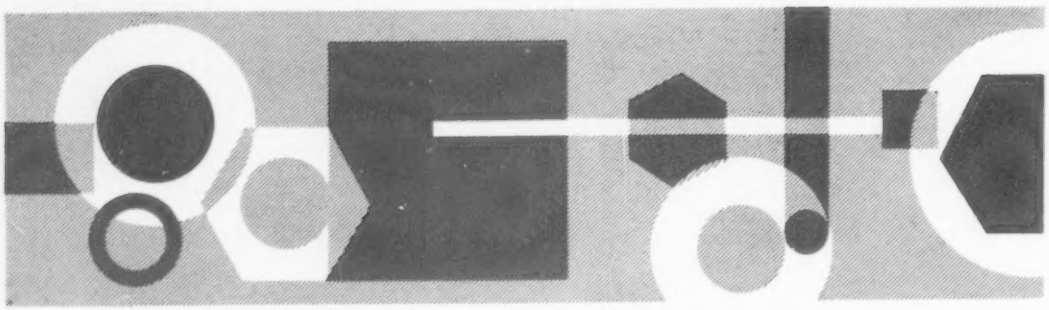

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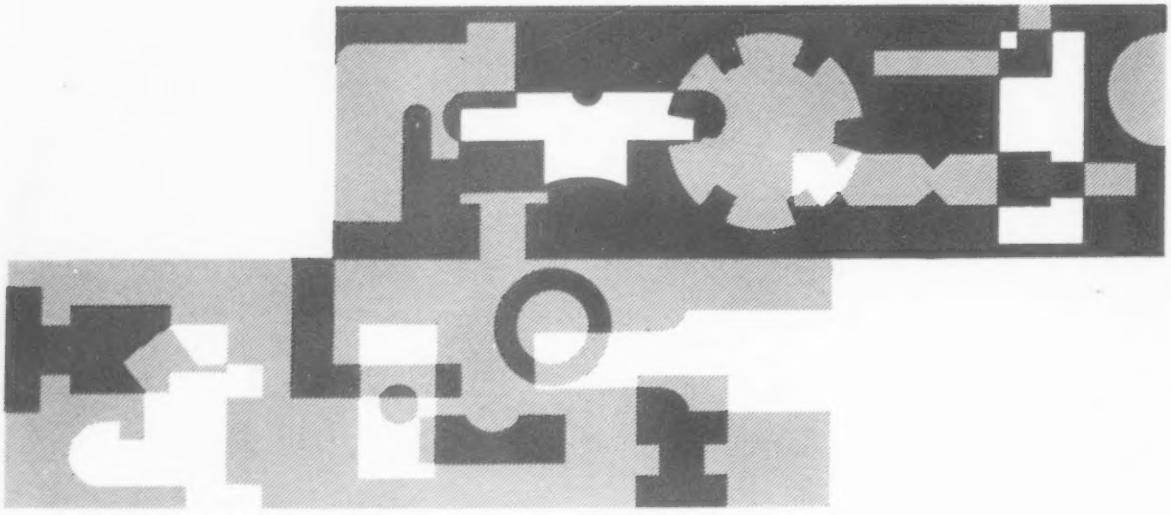

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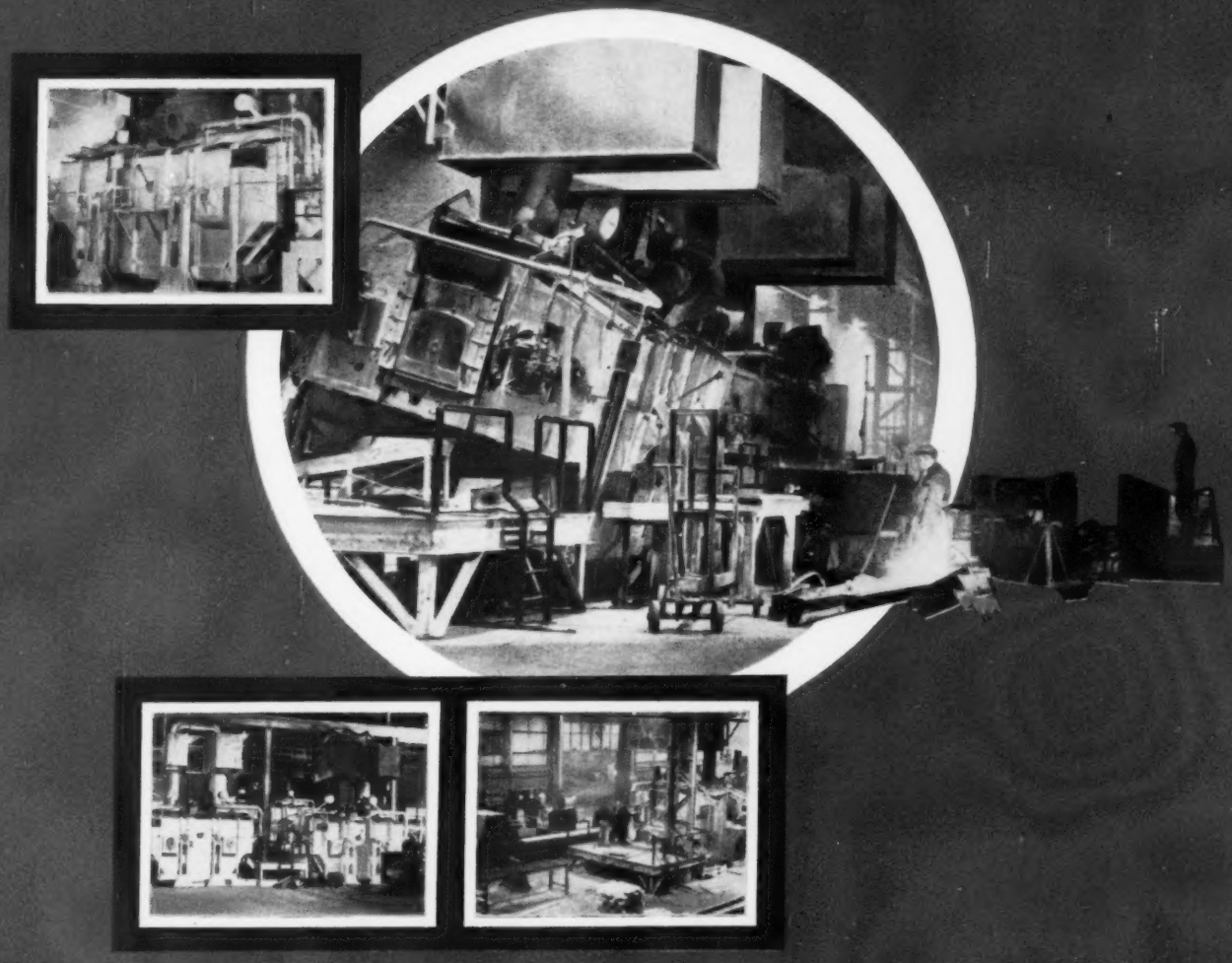

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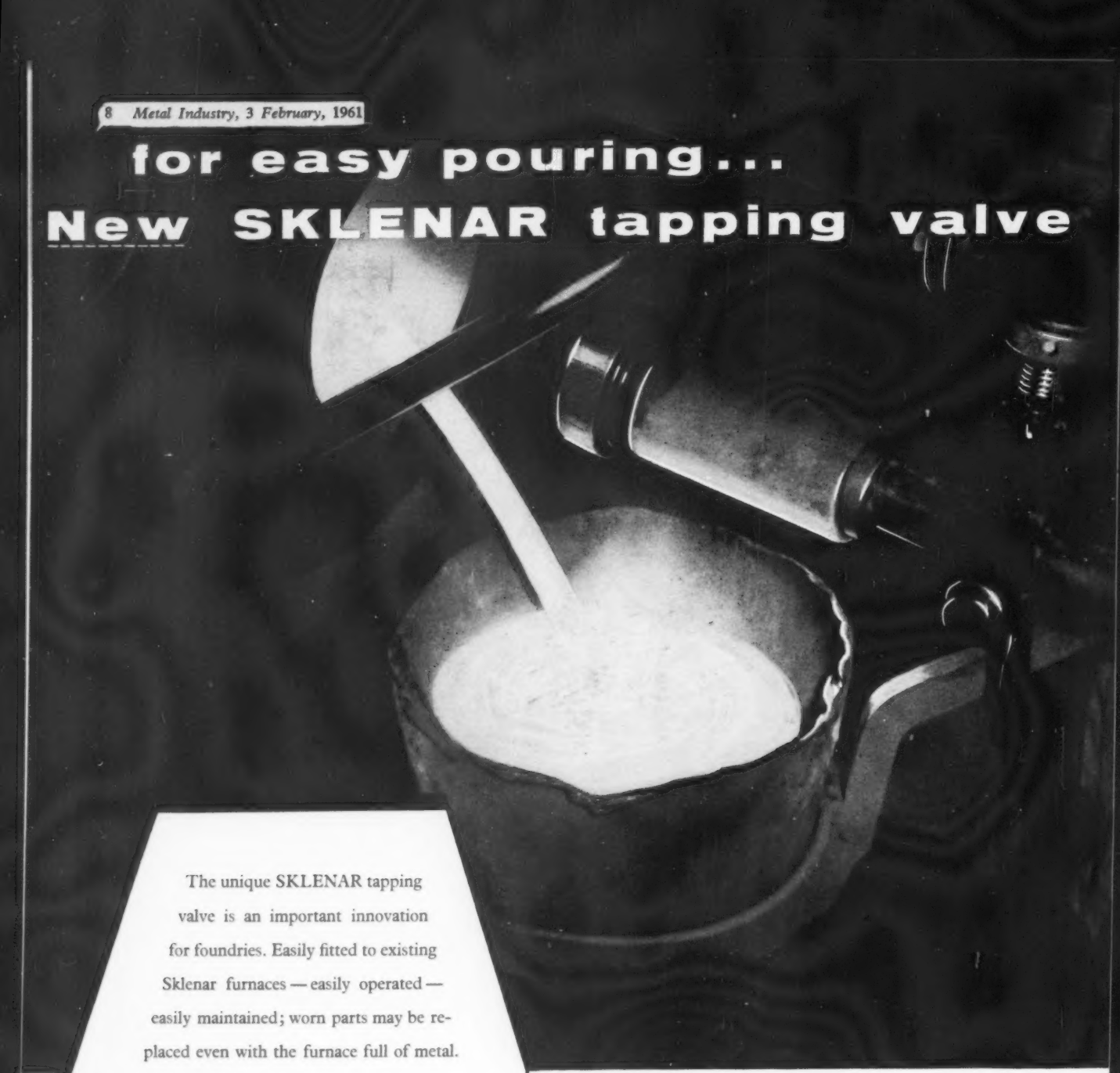

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FOUNDED 1909

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METAL INDUSTRY

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Broken Promises

ONE aspect of the export drive which is giving cause for serious concern is the growing number of reports in recent months of broken delivery promises, such as failure to complete a contract on time or to supply goods ordered by an overseas customer by the promised delivery date. Nothing is more calculated to act to this country's disadvantage as regards this vital question of exports than failures of this kind, and it is a matter which has been recently dealt with by Sir William McFadzean, President of the Federation of British Industries, when he addressed a meeting of the Midland Regional Council of the Federation.

This problem of broken delivery promises is admittedly not a new one, neither is this country the only one to fail in this respect, but the failures of others can never be an excuse for ourselves and Sir William said that he preferred to regard them as opportunities of which we should take full advantage. Continuing, he said there were many British companies which have an enviable reputation for getting jobs done and the goods delivered not only on time but often in advance of the promised date. This is as it should be, but the trouble is that those companies which fall down on the job do harm not only to themselves but also to all other British exporters. Unfortunately, a reputation for late deliveries spreads far more quickly and widely overseas than a reputation for contracts ably fulfilled to the letter.

The damage to our export drive caused by late deliveries needs no elaboration. If the product in question is, for example, a piece of machinery for a new factory overseas, its failure to arrive in time will hold up the start of production and thus cost the customer money, apart from creating a most unfavourable impression of British businessmen in the mind of the customer. A particular point which Sir William stressed was that although some of the causes for late deliveries (strikes, labour disputes, transport delays, etc.) may be beyond our control, industry itself also carries a heavy responsibility in this connection, and this responsibility is not limited to that of the company which actually exports the finished product. It is also that of his suppliers and all those who provide services for industry in one form or another. The failure of any one of his suppliers, whether it be of raw materials, of components, or even of one single unit, can cause an exporter to fall down on his job. Anything, in fact, which upsets the flow from one company to another will most certainly affect the delivery of the end product. Such troubles could arise under several heads as, for example, lack of liaison between production and sales staff, resulting in an order being accepted for delivery within an unreasonable time schedule; or pressure from one quarter or another to promise the impossible.

Industry must tackle this problem itself and, in full agreement with the Presidents of the Association of British Chambers of Commerce and the National Union of Manufacturers, the F.B.I. appeals to the chairmen and managing directors of every firm in this country which is concerned in any way with export, whether directly or indirectly, to make it their personal business to see that their company's performance on deliveries should not be open to reproach. The knowledge that this problem is being realistically tackled will surely be appreciated by our actual and potential customers overseas as a positive sign of Britain's determination to capture and maintain our proper share of world trade.

Out of the MELTING POT

Mechano-chemical

WITH all the current interest in high pressures and their effects, it would have been pardonable if the title of a brief communication from K. U. Snowden, of the Metallurgy School, University of Melbourne: "Effect of air pressure on the fatigue of lead and aluminium" were to have aroused expectations of the effect of high pressures. The experimental results reported are no less interesting, however, despite the fact that such expectations are not realized, the effect studied being that of air pressure below atmospheric (down to 2×10^{-6} mm. of mercury). The test pieces were prepared from strip of 99·999 per cent lead and super purity aluminium, and after annealing were fatigued in reverse plane bending at 500 cycles/min. The results for aluminium, plotted as log curves of fatigue life against air pressure (for two constant strain amplitudes of 0·140 and 0·092 per cent) indicate a steady increase in life with decrease of air pressure. The curves for lead, plotted in the same way for strain amplitudes of 0·140, 0·092 and 0·075 per cent, are quite different. All three have an initial portion (extending from atmospheric pressure down to about 0·15 mm. of mercury) over which the fatigue life remains unaffected by the change in pressure; an intermediate portion (between about 0·15 and 5×10^{-3} mm.) over which the fatigue life increases rapidly with decreasing pressure, and a final portion (from 5×10^{-3} to 2×10^{-6} mm.) over which the fatigue life again remains constant as the pressure is reduced. This marked change in fatigue behaviour would appear to be connected with variations in the rate of reaction between the gas and the metal at different pressures. It is interesting to note that there also occurs a fundamental change in the type of fracture, the test pieces failing by intercrystalline cracking over the initial portion of the curve and by extensive slip deformation under the conditions corresponding to the third, low-pressure portion of the curve. In the case of aluminium, the presence of air appears only to affect the rate of propagation of the cracks. It is suggested, however, that, at high temperatures, aluminium might show a behaviour similar to that of lead, whereas, at low temperatures, the behaviour of lead might come to resemble that of aluminium.

Factotum

APPLICATION of glass in various forms as a lubricant in the hot working, particularly the extrusion, of metals is a sufficiently well known, though not widely used, practice. The glass is applied to the metal billet, which has been heated to the hot working temperature, and is softened by heat received from the metal. There have been a number of suggestions of applying an inorganic medium at an earlier stage in which, for example, the material could serve as a heating medium, e.g. in a furnace of the salt-bath type in which the metal would be preheated. Theoretically, although perhaps not so practically, further advantages (no loss of heat during transfer, protection against scaling or other atmospheric contamination of the metal, lubricating action during the working of the metal) could be secured by working the metal, e.g. by drawing or pressing, while actually immersed in a bath of fused salt or other material of suitable composition. While considering the possibilities of such a procedure and of a set-up of this type, advantage might be taken of a somewhat less ambitious and easier process of achieving the above objectives. This process depends on the use of fused boric oxide for heating the metal to the hot working temperature and subsequently protecting and lubricating the metal while it is being worked. The boric oxide is held in a container in which is arranged vertically a tubular, internally water-cooled induction heating coil inside which a pool of molten boric oxide is formed, the surrounding granular boric oxide acting as a reservoir of the material and providing thermal and electrical insulation. The metal blanks are immersed, one at a time, in this pool of molten boric oxide for heating to the hot working temperature. On removal from the boric oxide melt, the metal blanks carry away on their surface a film of molten boric oxide, which acts as a protective and lubricant and which, after the working of the metal has been completed, is removed in a hot water bath, leaving the workpiece clean, smooth and free from scale.

Awaiting Application?

IN view of the familiar unfortunate reluctance to announce the introduction of new production processes, there is always the possibility that while, for example, the National Engineering Laboratory, in this country, the Institute of High-Pressure Physics, in Moscow, and the Institute of Metal Physics of the Academy of Sciences of the U.S.S.R., in Sverdlovsk, are experimenting with the hydraulic extrusion of metals, some producer of semi-manufactured products is already reaping the advantages of the process in the production of sections. Some producers, however, will still be interested in recently reported Russian investigations in this field. The experiments, in which aluminium, aluminium alloys and copper were extruded, showed the marked influence of the extruding liquid, both on the extrusion pressure and on the surface finish of the extrusions. Somewhat surprisingly, a hypoid lubricant, although it resulted in the lowest extrusion pressure, produced an unsatisfactory surface finish. Other liquids (transformer oil, paraffin, ethyl alcohol, water) resulted in satisfactory surface finish, but the extrusion pressure required was considerably higher. The best surface finish was obtained when using water, a further improvement being achieved when the billet was additionally coated with hypoid lubricant. There was evidence of a thin film of the liquid, used to apply the pressure, extruding on the surface of the metal. This should reduce die wear. The pressure required increased with increasing extrusion ratio and was also affected by the entry angle of the die. The lowest pressures were needed when the entry angle was 15°, which compares with 45° for the lowest pressure in the ordinary extrusion process in which the pressure is applied by a ram. The pressures required for hydraulic extrusion are much lower, e.g. 4,500 kg/cm^2 (for aluminium and an extrusion ratio of 0·9) as compared with 18,000 kg/cm^2. While the mechanical properties of sections produced by the two methods of extrusion were substantially the same, given the same degree of deformation, there was much less variation in hardness across the cross-section of hydraulic extrusions, the hardness remaining constant and then rising only slightly in the surface region.

Skimmer

EFFECT ON MICROSTRUCTURE MECHANICAL PROPERTIES AND CORROSION RESISTANCE

Iron in Aluminium-Magnesium-Silicon Alloys

By M. PAGANELLI and F. SACCHI

In this article, which has been specially translated from "Alluminio," the authors discuss the results of work carried out at the Istituto Sperimentale dei Metalli Leggeri, on the influence of iron in one of the aluminium alloys used in architectural and other decorative applications.

ALUMINIUM - MAGNESIUM-SILICON alloys are among the most widely used and the oldest of the light alloys. Their origin can be traced back to the experiments of Wilm, who observed the hardening effect exerted by the presence of 0·5 per cent magnesium on commercially pure aluminium when it was quenched from 500°C. and aged. In those days, aluminium contained a large quantity of silicon as an impurity.[1]

The wrought aluminium alloy containing 0·65 per cent magnesium-0·4 per cent silicon, P-ASO.4G, combines moderate strength with high corrosion resistance and responds well to mechanical polishing, anodizing and dyeing. Consequently, it is particularly suitable for door and window frames, curtain walling and other decorative architectural applications, metal furniture, parts of the bodywork of motor vehicles, and for television aerials. It has been adopted recently in Italy in order to take advantage of its better anodizing properties and lower alloying content compared with the existing alloys of the aluminium-magnesium-silicon series, and also to meet the demands for an alloy equivalent to the American 6063 (formerly 63S).[2]

The results are discussed here of some tests carried out at the Istituto Sperimentale dei Metalli Leggeri, Novara, to determine the influence of iron content on the properties of aluminium-0·65 per cent magnesium-0·4 per cent silicon alloy extrusions, for which the appropriate Italian standard specifies a maximum of 0·35 per cent iron.

Preparation of the Alloys

Four alloys, containing 0·08 per cent, 0·15 per cent, 0·3 per cent and 0·5 per cent iron respectively, together with 0·65 per cent magnesium and 0·4 per cent silicon, were prepared from either 99·99 per cent, 99·7 per cent or 99·5 per cent grade aluminium, magnesium and aluminium-iron and aluminium-silicon hardener alloys. Ingots, 80 mm. in diameter, were cast from approximately 720°C. into a cast iron mould coated with graphite. From each of the large ingots, the analyses of which are given in Table I, four small billets, 120 mm. in height, were cut and designated either *A*, *B*, *C* or *D*. After homogenizing at 500°C. for 16 hr., the billets marked *A* and *B* were extruded to 14 mm. diameter rod for determination of mechanical properties, whilst from ingots *C* and *D* a section suitable for anodizing tests was made. In order to determine the effects of the method of quenching, ingots *A* and *C* were air quenched, and ingots *B* and *D* were water quenched. Extrusion conditions are listed in Table II.

Mechanical properties of the four alloys were determined in the following conditions :—

Tpa N = Quenched at the press in air and naturally aged.

Tpa A = Quenched at the press in air and aged 12 hr. at 160°C.

Tp N = Quenched at the press in water and naturally aged.

Tp A = Quenched at the press in water and aged 12 hr. at 160°C.

T53/2 N = Solution treated 2 hr. at 530°C. and naturally aged.

T53/2 A = Solution treated 2 hr. at 530°C. and aged 12 hr. at 160°C.

The anodizing tests were applied to the following conditions: Tpa N, Tpa A, Tp N, Tp A.

An oil bath was employed for the artificial ageing treatments, which were begun about 20 hr. after quenching.

Metallographic Examination

Microstructures of the ingots are illustrated in Figs. 1 and 2. The only undissolved constituents visible in the cast condition were eutectics of Mg_2Si and $FeAl_3$, just a very small quantity of the latter compound being present in the alloy with 0·08 per cent iron. As iron content was increased, however, the quantity of undissolved $FeAl_3$ increased rapidly so that in the alloy with 0·5 per cent iron there was a network of eutectic around each dendrite arm. In the alloys of high iron content, the compound $FeAl_3$ appeared as Chinese script, and since this is similar in form to $\alpha AlFeSi$, a small part of the silicon may have entered the iron-rich compound. The quantity of silicon available to combine with the iron must have been small, however, because of the marked affinity of silicon for magnesium, in combination with which Mg_2Si is formed.

Macrostructures midway along the length of representative rods before and after solution treatment are illustrated in Figs. 3 and 4. Comparison of the macrostructures indicated that :

(a) As iron content increased, grain size decreased.

(b) Rod which was air quenched at the press was almost completely recrystallized (Fig. 3a).

(c) Re-solution treatment caused grain size to increase, particularly in the peripheral layer of the two alloys of lowest iron content (Fig. 3b). In order to explain the growth of very large grains at the periphery of an extrusion which was already almost completely recrystallized, one must

TABLE I—COMPOSITION OF THE EXPERIMENTAL ALLOYS

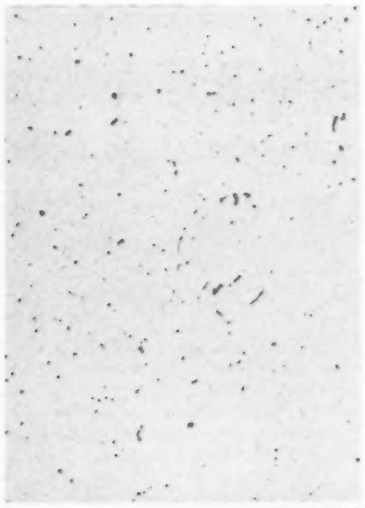
Element (per cent)	Experimental Alloys				Standard Specification Values
	2518	2520	2521	2522	
Iron	0·078	0·16	0·31	0·51	≤ 0·35
Silicon	0·40	0·40	0·40	0·40	0·2 — 0·6
Magnesium	0·67	0·69	0·68	0·68	0·45 — 0·85
Copper	0·002	0·003	0·006	0·008	≤ 0·1
Zinc	0·015	n.d.	0·014	0·018	≤ 0·1

TABLE II—EXTRUSION CONDITIONS FOR ALL THE ALLOYS EXAMINED

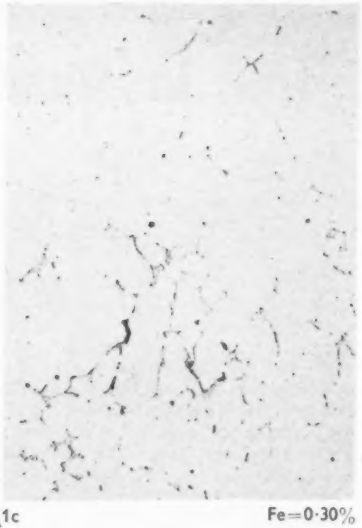
Preheating temperature	500°C.
Duration of preheat	16 hr.
Container temperature	490°C.
Diameter of ingot	80 mm.
Height of ingots for tests A, B, C, and D	120 mm.
Extrusion speed	6 m/min.
Length of discard	15 mm.
Extrusion ratio	
Ingots A and B	32·6*
Ingots C and D	3·4**
Quenched at the press	
Rod A and Section C	in air
Rod B and Section D	in water

*14 *mm. dia. rod*
**Section*

1a Fe=0·03%

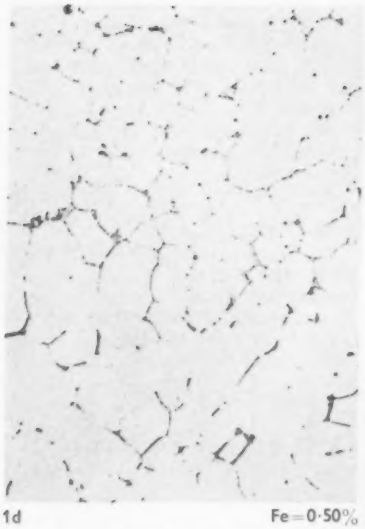


1b Fe=0·15%



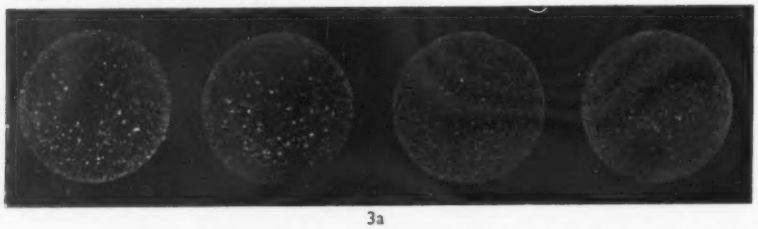
1c Fe=0·30%

Fig. 1—Microstructure of the cast alloys with increasing iron content. Eutectics of Mg_2Si and $FeAl_3$ are visible. Etched in 0·5 per cent HF. (× 100)



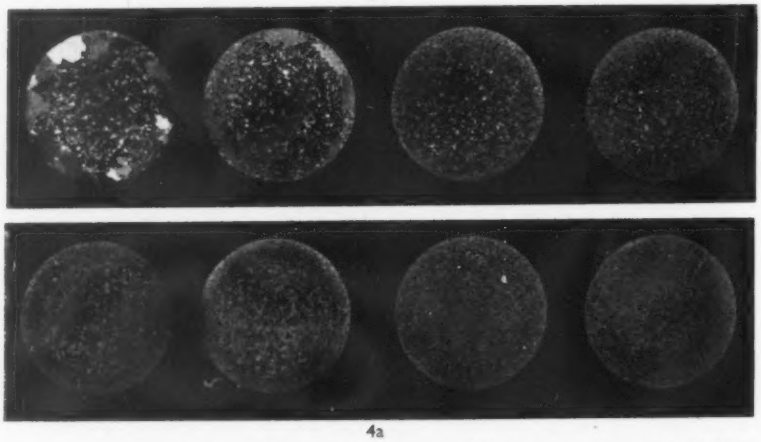
1d Fe=0·50%

Fig. 2—Detail of Fig. 1d (× 500)



3a

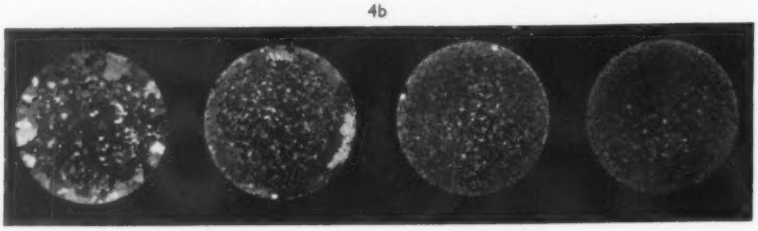
Fig. 3—Macrostructures of extruded rods (from left to right 0·08 per cent, 0·15 per cent, 0·30 per cent and 0·50 per cent Fe); (a) quenched at the press in air; (b) as (a) but re-solution treated. Etched in HF + HCl + HNO_3 (× 1·8)



3b

4a

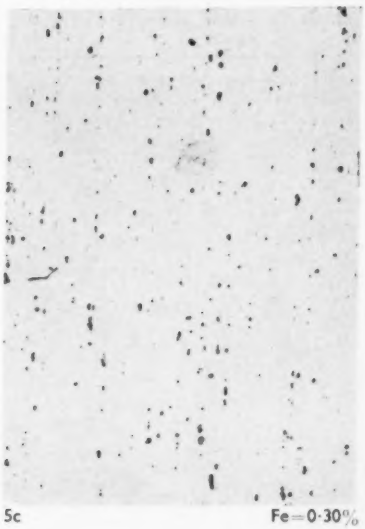
Fig. 4—Macrostructures of extruded rods (from left to right 0·08 per cent, 0·15 per cent, 0·30 per cent and 0·50 per cent Fe); (a) quenched at the press in water; (b) as (a) but re-solution treated. Etched in HF + HCl + HNO_3 (× 1·8)



4b

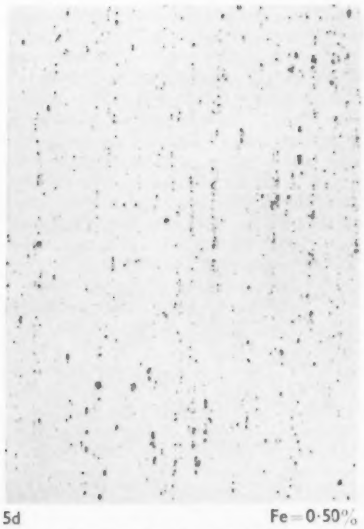
5a Fe=0·08%

5b Fe=0·15%



5c Fe=0·30%

Fig. 5—Macrostructures of extruded rods, quenched at the press in water and artificially aged, showing the increase in the number of $FeAl_3$ particles with increase in Fe content. Etched in 0·5 per cent HF. (× 100)



5d Fe=0·50%

Fig. 6—Detail of Fig. 5a. Etched in 0·5 per cent HF. (× 500)

assume that stresses formed at the periphery were not completely relieved during extrusion and the grains remaining in the cold worked condition, with near the critical level of cold work, recrystallized during heat-treatment. Such behaviour can easily be explained. In an air-quenched extrusion the periphery obviously cools much more rapidly than the interior and consequently recrystallization, which does not occur instantaneously but in a finite interval of time, may be completed in the core but not in the outer layer. In contrast to the aluminium-0·65 per cent magnesium-0·4 per cent silicon alloy, which has a very low level of critical cold work at 530°C.,[3] the presence of residual cold work is not revealed in many other aluminium alloys by a subsequent heat-treatment.

(d) The rapid cooling of the water-quenched extrusions practically prevented recrystallization (Fig. 4a).

(e) Complete recrystallization occurred during subsequent solution treatment (Fig. 4b), with the result that macrostructures of rods after solution heat-treatment were similar, irrespective of the original method of quenching.

Microstructures of longitudinal sections of the rods midway along the lengths are reproduced in Figs. 5-8. As iron increased from 0·08 per cent (Fig. 5a) to 0·5 per cent (Fig. 5d), the quantity of $FeAl_3$ increased considerably. Even at a magnification of ×500 (Figs. 6 and 7), no particles of Mg_2Si

Fig. 7—Detail of Fig. 5d. Etched in 0·5 per cent HF. (× 500)

Fig. 8—Microstructure of the surface layer of extruded rod of the alloy with 0·5 per cent Fe. Etched in 0·5 per cent HF. (× 100)

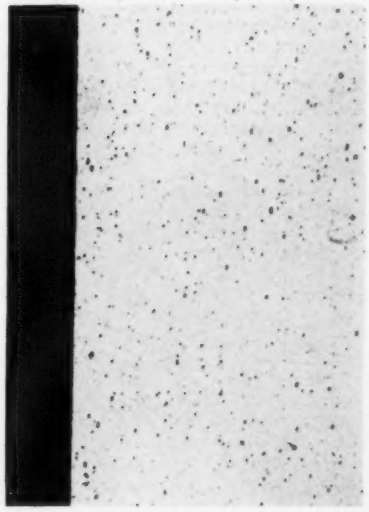


TABLE III—MECHANICAL PROPERTIES OF THE NATURALLY AGED ALLOYS

Alloy No.	Fe (per cent)	Condition	U.T.S. kg/mm²	0·2 per cent proof stress kg/mm²	Elongation (per cent)	Brinell Hardness
2518	0·08	Tpa N	16·5	7·1	30·6	50
		Tp N	20·4	9·9	26·1	55
		T53/2 N	16·4	7·4	24	59
2520	0·15	Tpa N	16·9	7·1	28·2	51
		Tp N	21·6	10·9	24·1	56
		T53/2 N	18·2	8·0	30·1	56
2521	0·30	Tpa N	16·7	6·7	28·3	51
		Tp N	20·2	10·3	24·4	53
		T53/2 N	17·9	7·9	29·7	54
2522	0·50	Tpa N	16·4	6·6	27·7	47
		Tp N	19·3	9·5	23·3	51
		T53/2 N	17·3	7·4	29·3	52
Minimum values specified by Alcoa for 6063-T4			≥15·5	≥ 7	≥14	

TABLE IV—MECHANICAL PROPERTIES OF THE ARTIFICIALLY AGED ALLOYS†

Alloy No.	Fe (per cent)	Condition	U.T.S. kg/mm²	0·2 per cent proof stress kg/mm²	Elongation (per cent)	Brinell Hardness
2518	0·08	Tpa A	19·9	12·4	21·8	66
		Tp A	25·0	18·5	21·3	78
		T53/2 A	19·6	11·6	28·0	72
2520	0·15	Tpa A	19·5	12·0	22·4	64
		Tp A	27·0	21·4	18·9	77
		T53/2 A	20·3	12·6	27·1	71
2521	0·30	Tpa A	19·0	11·3	23·5	61
		Tp A	25·9	20·7	18·9	76
		T53/2 A	20·0	12·7	26·3	72
2522	0·50	Tpa A	17·8	10·2	24·1	58
		Tp A	23·5	17·6	19·0	69
		T53/2 A	19·1	12·1	24·7	67
Standard specification values for alloy P-AS 0·4GTpa A			19—23	12—19	10—20	55—75
*TA16			24—28	21—25	11—15	70—90
Minimum values specified by Alcoa for 6063		—T5	≥15·5	≥11·2	≥ 8	
		—T6	≥21·1	≥17·6	≥10	

†*Alloys aged 12 hr. at 160° C.*
**Re-heat-treated and aged at 160° C.*

were visible, indicating that the solution treatment prior to extrusion had been completely effective.

By comparing the structure at the centre of the rods (Fig. 5d) with the structure at the edge (Fig. 8) it was apparent that intermetallic compounds were much more finely divided and less markedly aligned at the edge than in the core. This phenomenon is typical of extrusions with a large quantity of intermetallic particles, and is termed "hypercorroyage" by some French workers,[4] who suppose that, during extrusion, supersaturation of $FeAl_3$ occurs in the periphery, followed by reprecipitation on a fine scale during subsequent cooling. The authors, however, believe that it is simply due to the plastic deformation which occurs at the periphery being greater than, and of a different type from, that which occurs at the core.

Mechanical Properties

The mechanical properties of naturally aged specimens are given in Table III and those of artificially aged material in Table IV, the ranges specified by the Italian Standard UNI 3569 and also the minimum values quoted by Alcoa[2] for the American alloy 6063 also being provided for the purposes of comparison. Results indicated that:

(a) Mechanical properties of the artificially aged alloys were always much higher than those of naturally aged material.

(b) By increasing iron content from 0·08 per cent to 0·5 per cent, mechanical properties remained almost constant, slightly better values being obtained with 0·15 per cent iron.

(c) All four alloys, whether naturally or artificially aged, were strongest when quenched at the press in water, that is, condition Tp N in Table III and Tp A in Table IV.

(d) Mechanical properties of re-heat-treated alloys were similar to those obtained for air quenched extrusions. In other words, re-heat-treatment of water quenched extrusions resulted in a decrease in strength.

(e) Observations (c) and (d) can be explained by referring to the macrostructures illustrated in Figs. 3 and 4. In the section concerned with metallographic examination it was stated that the water quenched extrusions were only partly recrystallized, the air-cooled extrusions almost entirely recrystallized, and after re-heat-treatment both were completely recrystallized. Thus, the press effect was reduced by air quenching and lost by re-solution treating.

The high strengths of water quenched extrusions are attributed partly to the retention of the press effect and partly to rapid cooling; reduction in strength after re-heat-treatment is attributable to loss of the press effect. Strengths of air quenched extrusions were slightly lower than those water quenched because of the slower cooling rate, but a little of the press effect was retained and so properties were similar to those obtained after re-heat-treatment.

(f) Strength, particularly proof stress, of the re-heat-treated alloys was always well below the minimum values specified by the Italian Standard for the TA 16 condition, and also below the minimum values specified for 6063 T6 by Alcoa (Table IV). Similarly, material in the extruded air quenched and artificially aged condition had low ultimate tensile strengths and 0·2 per cent proof stresses, but elongation values were always very high. In this connection, the results listed below of further tests carried out at the I.S.M.L. laboratories are relevant.

(1) Strength of alloy P-AS 0·4 G is increased if, with constant Mg_2Si content, about 0·1 per cent silicon in excess of the stoichiometric composition to form Mg_2Si is present.

(2) If a stretching operation after quenching is not to be included, specified values for 0·2 per cent proof stress can only be attained by having a high Mg_2Si content.

(3) The period of delay between quenching and the beginning of artificial ageing appreciably influences mechanical properties, highest strengths being obtained when the period of delay is short.

References

1 C. Panseri; "Manual of the Technology of Wrought Light Alloys". Hoepli, Milan, 1957, 694.
2 Alcoa Aluminium Handbook, 1956.
3 E. di Russo and D. Gualandi; I.S.M.L. Monographs, No. 2, 1958.
4 J. Herenguel and P. Lelong; *Rev. Met.*, 1958, LV, 1057.

(To be concluded)

Finishing Supplement

Vitreous Enamelled Aluminium

Spraying 'MS' vitreous enamelled panels

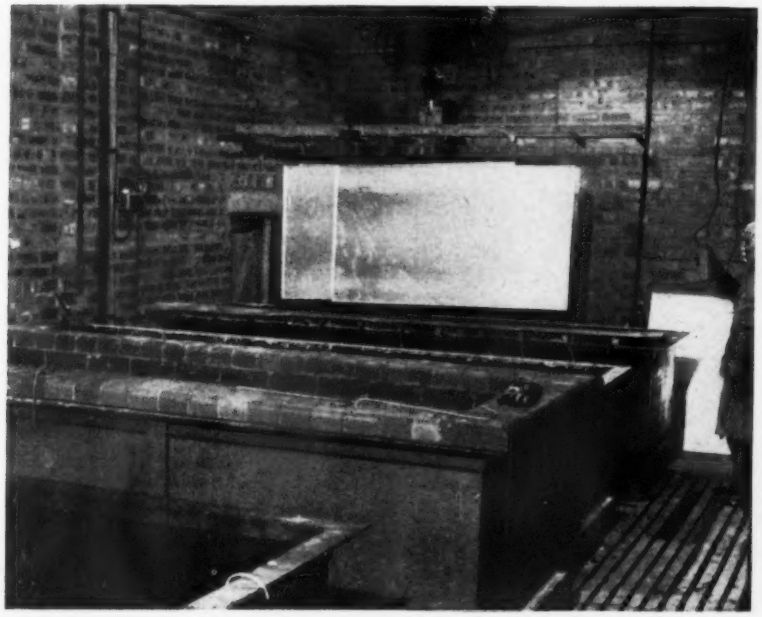
IN an earlier article (METAL INDUSTRY, 6 January 1961, p. 7), the preparation of frit for vitreous enamelling aluminium, the control of quality and process development were described. The present article deals with the enamelling process as practised on a production basis at the works of Matthew Swain Ltd., of Manchester. Established some 80 years ago, the firm employs roughly 300 persons in a number of departments, respectively engaged on iron founding, vitreous enamelling, assembly, sheet metal and wire working, including the vitreous enamelling of aluminium. The company's products are firegrates, cast-iron holloware, and architectural metal work such as "MS" vitreous enamelled panels.

Buildings and Plant

The excellent production shop in which the latter operation is carried out is a newly reconstructed rectangular building on one floor measuring 150 ft. long by 40 ft. wide with a pre-treatment department adjoining. Its clean appearance is accentuated by the concrete floor being clear of constructional obstructions, while the roof lights give good natural illumination assisted, when necessary, by pendant strip lights. Powerful forced ventilation removes spray fumes through ducting.

In the pre-treatment department are four tanks respectively for 10 per cent caustic soda dip, cold water rinse, 30 per cent nitric acid dip, and cold water rinse. The alkali tank is heated by rows of immersion heaters, and to prevent contamination the tank linings are of rubber, except in the case of that holding the nitric acid, which is lined with acid-resisting brick. Materials under treatment are handled in and out of the baths by remotely controlled overhead electric hoist suspended from a monorail spanning the length of the shop.

Part of the pre-treatment room for preparing panels for vitreous enamelling



Plant in the enamelling department is laid out in a very logical arrangement, with wide adjoining spaces which will permit doubling the capacity when necessary. Three spray booths are built up to the wall which supports the hoods, fans and ducting for fume extraction, the actual spray being delivered from Aerograph fine jet spray guns. In the centre of the department, alongside these booths, is a Parkinson Cowan infra-red dryer, the roof of which has a narrow opening throughout its length to permit sheets to pass through it and undergo heating while suspended from an overhead conveyor. This conveyor is a motorized Teleflex, which makes an elliptical circuit through the dryer and past the spray booths, allowing sprayed sheets to be hung by the spray operators on the conveyor so that they may be transported through the dryer.

In line with the dryer in the enamelling department is the production furnace designed and constructed by Kilns and Furnaces Ltd. It is electrically heated and has split (horizontally moving) entry doors and a split roof to allow sheets suspended from an overhead monorail to pass through it. The clamping brackets suspended from the trolleys on this monorail carry sealing plates intended to slide along the furnace roof so as to cover the opening and reduce heat loss. The doors are

General view of the vitreous enamelling department at Matthew Swain Ltd.

suspended from a roller track and are hydraulically operated so as to move sideways to expose the passage through the furnace. The latter has four zones and heating elements all round. The comprehensive controls include presetting devices, pyrometers in the furnace, and automatic regulators and recorders.

Further towards the exit end of the same shop is a bonding department, where infilling materials are bonded on to the back of the enamelled sheets when required by the customer. Infillers used include plywood, asbestos fibre, glass fibre, polystyrene, etc. These are affixed by coating the plate with an adhesive and bonding it to the infiller under a hydraulic press. Such infillers greatly improve thermal and acoustic insulation and the visual appeal, too, of the finished enamelled architectural panels.

A new enamel preparation shop is under construction alongside this department for preparing the enamel.

Enamelling Aluminium

The dry frit from the batch production line at Ferro Enamels Ltd. is received at the Matthew Swain works and duly mixed and milled in the Boulton ball mills there so as to provide the enamel "slip". This then passes through the following stages:—

(1) Checked for fineness of grinding, passing if not more than 0·1 gm. of residue on a 325 mesh sieve.

(2) Checked for colour by spraying aluminium sample, firing and comparing with standard.

(3) Check for gravity by obtaining the weight of slip in a standard volume measure.

At the Matthew Swain works it has been confirmed that only selected types of aluminium can be satisfactorily enamelled. Typical of these are NS3 and S1C to specification B.S.1470. The sheet material is received and subsequently flanged or louvred, if required, at the works for the present main output of architectural metal work.

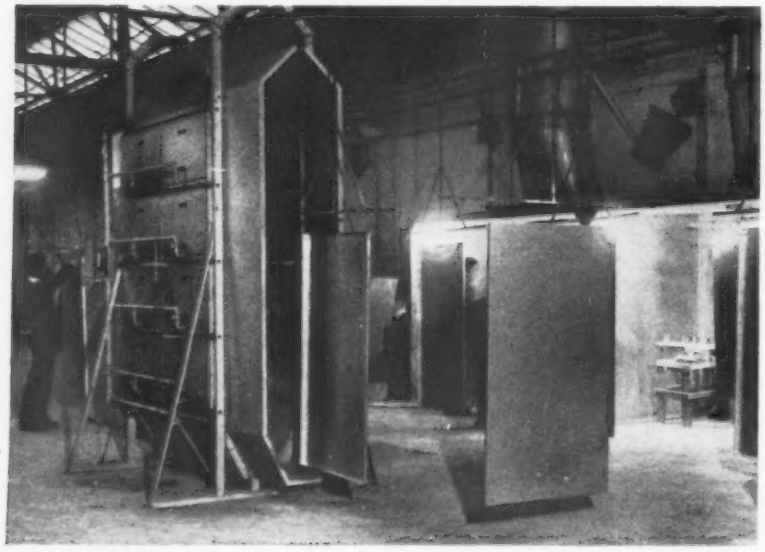
The aluminium sheets are prepared for vitreous enamelling by one of two methods.

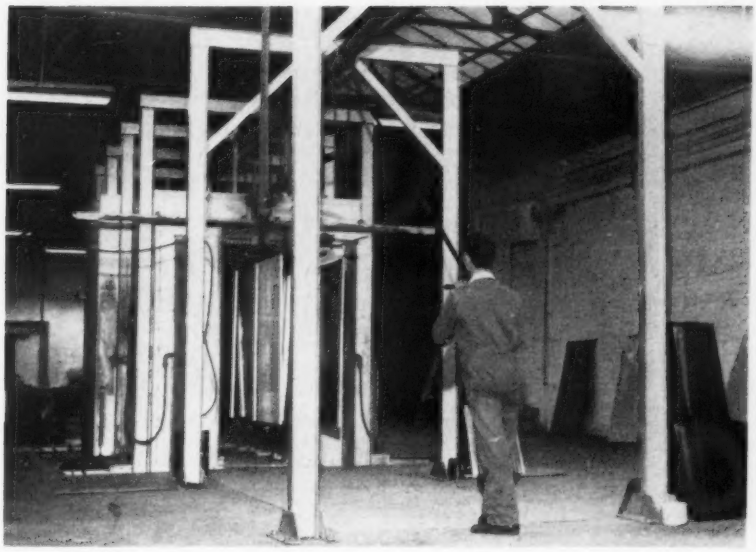
Preparation method (1) involves dipping them in the 10 per cent caustic soda bath for 2-5 min., followed by a cold water rinse. Then, to remove smuts, the aluminium sheets are passed through the 30 per cent nitric acid for 2-6 min., again followed by a cold water rinse. The alternative preparation method is by using a chromate pickle.

The prepared aluminium sheets are pre-fired at 550° C. for 5-10 min. in the electric furnace and delivered to the spray booths where they receive one coat of enamel 0·003 to 0·007 in. thick. The sprayed sheets are then put on the Teleflex conveyor and dried by passing through the Parkinson Cowan dryer, preparatory to fusing in the electric furnace when they are heated at 560° C. for 5-15 min. for their final treatment before cooling in the atmosphere.

Tests are carried out on the fused-enamel aluminium. A spalling test incorporates a procedure by which the specimen is deformed and immersed in a 5 per cent solution of ammonium chloride for 24-96 hr., after which it is examined to see if there is flaking of the enamel. An acid resistance test with a 10 per cent solution of citric acid applied for 20 min. is used to

Sprayed panels entering the infra-red dryer





Fusing vitreous enamelled panels

establish whether the enamelled aluminium is sufficiently resistant to corrosives found in domestic use. These examinations are carried out on every batch of enamel mixed.

Because of the comparative softness of the aluminium, process and transport workers handle it with gloves throughout, and very careful precautions are taken in packing.

Special Properties

It has been found that vitreous enamelled aluminium (when the right frits and aluminium have been used) exhibits special characteristics. It may be sawn, drilled, cut and punched without material chipping. The enamel will stand flexing to some extent, but it is not quite as hard as vitreous enamelling on steel which has been fired at higher temperatures. The frits used give very good coverage and adhesion when the right aluminium is selected.

The enamelling department described above is heavily engaged in providing interior and exterior panels, fascias, mouldings, frames and similar components required for public buildings such as schools, hospitals, public authority offices and business premises of all types and, no doubt, domestic architecture.

Tentative Specification

A tentative specification for vitreous enamel on aluminium (see METAL INDUSTRY, 7 October 1960, p. 293) was published last year by the Vitreous Enamel Development Council. This refers to wrought aluminium alloys such as 1C, N3, H20 and H30, and castings LM.6, LM.8 and LM.18. Details are given of a number of tests similar to those described in this article, and further classifications are also mentioned. To obtain an additional picture of the process, therefore, reference should also be made to this specification.

Men and Metals

After 31 years' service with George Cohen Sons and Company Limited, **Mr. B. A. Thurgood** has been appointed resident director of George Cohen Australian Scrap Company Proprietary Limited, Sydney, the company whose formation was announced towards the end of last year. Mr. Thurgood, who until recently was George Cohen's branch manager in Morriston, near Swansea, has already left to take up his new post in Australia.

Managing director of Baird and Tatlock (London) Limited, also Hopkin and Williams Limited, and W. B. Nicolson (Scientific Instruments) Limited, **Mr. J. E. C. Bailey** is leaving the U.K. this week-end for a tour of the companies' branches and agents in Africa. He will be visiting Nairobi, Ndola, Salisbury, Johannesburg, Cape Town, and Durban.

Joining the staff of the Castrol Group of Companies, **Mr. Laurie Denison,** for his first assignment, will be posted to the group's associate company in Brazil, Castrol (Lubrificantes) S.A., as technical consultant on industrial oils.

Changes in the board of Kestner Evaporator and Engineering Company Limited have been announced as follows:—**Mr. B. N. Reavell,** B.Sc., A.C.G.I., M.I.Mech.E., M.I.Chem.E., has been appointed chairman; **Mr. G. H. Black,** managing director; **Mr. C. A. Pither,** F.C.A., director and secretary; **Mr. J. W. Grose,** B.Sc., A.C.G.I., A.M.I.Chem.E., continues as an executive director.

A delegation from the Federation of British Industries will be leaving on a visit to Spain next week to discuss the opportunities for increasing Anglo-Spanish trade. Included in the delegation are **Sir William McFadzean** (President of the Federation and chairman and managing director of British Insulated Callender's Cables Limited); **Mr. D. le S. Campbell,** M.C. (director of Davy-Ashmore Export Company Limited, Efco Limited, Birlec-Efco Limited and others); **Mr. G. H. W. Cullinan** (director, Shell Chemical Company, Petrochemicals Limited, etc.); **Sir Kenneth Preston** (chairman of Stone-Platt Industries Limited and director of Averys Limited) and **Mr. C. R. Wheeler,** C.B.E. (President, British Iron and Steel Federation, and vice-chairman, Associated Electrical Industries Limited).

It is reported that **Mr. R. G. Hooker** has been appointed deputy managing director of K and L Steelfounders and Engineers, a member of the George Cohen 600 Group.

Chairman of the Wellman Smith Owen Engineering Corporation Ltd., **Sir Peter Roberts,** Bt., M.P., has been appointed deputy chairman of the Indian Steelworks Construction Co. Limited.

New directors for Firth-Vickers have been appointed as follows:—**Mr. A. G. Cleghorn,** general works manager, Blackheath, Birmingham, and **Mr. W. H. Wentworth,** general sales manager, Sheffield, have both been appointed special directors of Firth-Vickers Stainless Steels Limited.

It has been announced by George Kent Limited that they have appointed **Mr. Rodney Kent** to be deputy chairman, and **Mr. Walter May** to be assistant managing director of the company, and have also appointed **Mr. John G. Vaughan,** F.C.A., as a director of the company.

The appointment of **Mr. M. T. Rimmer** as secretary and accountant of Fawcett Preston and Company Limited, and secretary of New Eagle Foundry, of Birmingham, has been announced. Both these companies are members of the Metal Industries group.

An invitation has been accepted by **Mr. P. W. Robinson** to join the board of the Consolidated Zinc Corporation. It is understood that he has been released by the directors of the Rio Tinto Mining Company of Australia from his post as deputy managing director of that company.

Products and Processes

TRENDS IN THE DEVELOPMENT, APPLICATION, PROCESSING, DESIGN AND WORKING OF NON-FERROUS METALS AND THEIR PRODUCTS

Specialized Equipment for Special Metals

A FLOATING zone, electron beam melting and refining furnace, introduced recently in the U.S. by Materials Research Corporation, can produce single crystals from most of the refractory metals in sizes up to 15 in. long by ¼ in. diameter. Since the manufacturers feel that equipment of this kind will be of interest mainly to laboratories already equipped with ample mechanical pumping facilities, it is supplied with only a diffusion pump.

Another recently introduced piece of equipment using electron beam energy is the Model B-1520 Beamatron welding machine, made by High Vacuum Equipment Corporation. Designed for 3 kW electrical supply, it has an 1,800 ft^3/min. vacuum pumping system, which can evacuate the stainless steel chamber to 0·01 micron pressure in 5 min. It is claimed that the simple design of the Beamatron welder permits operation by semi-skilled workers, and that such "difficult" metals as zirconium, beryllium and tungsten can be welded with the same ease as stainless steel.

Aluminium Sandwich Panel Construction

FOR sandwich panel and other metal-to-metal and metal-to-plastics bonding, Plymaster ACA.1050 provides an adhesive system consisting of aluminium foil or sheet which has been pre-coated with a 100 per cent solids, specially formulated, structural adhesive. It was originally developed for lightweight, non-load-bearing sandwich panel manufacture in the aircraft industry, and is a product of Rubber and Asbestos Corporation, whose agents in this country are Omni (London) Limited.

Among the claims made for this material are: excellent peel strength and filleting properties, superior shear and compressive strengths, greater ease of handling (no metal cleaning, no mixing, minimum toxicity, no core preparation, permits storing at room temperature), lighter weight bonded assemblies, and lower overall costs.

At present, it is produced in roll form in widths up to approximately 48 in., and lengths up to approximately 400 ft. Currently available material consists of 5,052 full hard aluminium alloy in nominal foil thickness of 4 mils or 8 mils, coated to an adhesive weight of 0·028 ±0·002 lb/ft^2.

Other non-heat-treatable aluminium alloys in coil form can be coated with the adhesive to specific requirements. Heat-treatable alloys, even where not available in coil form, may also be successfully converted into Plymaster ACA.

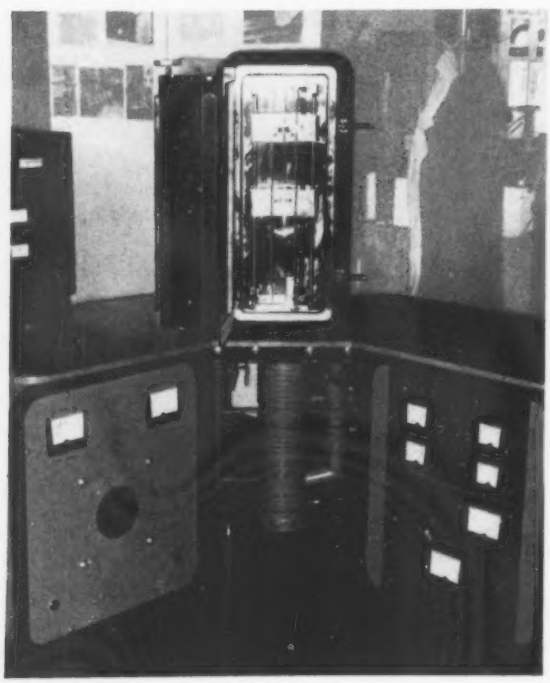
Measuring Thickness of Sprayed Coatings

WITH the extensive present-day use of the metal spraying process, inspection and quality control become more urgent. Because thickness plays an important part in the protective value of sprayed metal coatings, it is essential that this should be adequately checked.

The introduction of a new type of measuring instrument, the Metallisation audio thickness gauge, goes a long way to reducing the problem. This instrument, which has been designed specifically for sprayed zinc and aluminium coatings, and enables large areas to be checked rapidly, is being made by Metallisation Ltd.

The principle of its operation is based upon an exploring head which may be moved quickly over the coated surface. The instrument having been set to indicate a minimum thickness, gives an audible warning of areas which are below the required thickness. Accurate test specimens are used to set the gauge to any desired thickness between 0·002 in. to 0·012 in. The set is completely portable, fully transistorized, and the miniature operational battery has a life of over four months. It is unaffected by magnetic fields or stray magnetism.

Whilst the exploring head is designed for flat surfaces,



Left: Floating zone electron beam melting and refining furnace designed by Materials Research Corporation

Below: Electron beam welding equipment built by High Vacuum Equipment Corporation

adaptors are being designed to enable the unit to measure curved surfaces and tubes.

Cleaning and Lubricating Dies

PROVIDING die-casting machine operators with an air jet for cleaning the dies and an oil mist spray to give efficient lubrication, a hand spray gun has been introduced by the Foundry and Metallurgical Equipment Co. Ltd. The air jet and oil spray are independently operated and are applied at right-angles to the die faces to allow penetration into deep cavities. Positioning of the gun is facilitated by swivel-joint connections of the flexible air and oil hoses.

The gun can be supplied with a single-facing head for spraying one die at a time, or with a double-facing head for spraying both dies simultaneously. Each head carries a phosphor-bronze scraper blade for cleaning flash from the joint of the dies, and a suspension hook for hanging the gun between operations.

The gun is fitted with stainless steel valves and has a single lever-action control giving immediate response. The density of the spray can be adjusted and then locked.

The "Fame" hand spray gun is available with tube lengths of 8 in., 12 in., and 18 in. It is supplied complete with 1 gal. oil container, with filter and hinged lid, and two 6 ft. armoured hoses.

Improvements in Plating Barrels

TWO improvements to plating barrels:—the introduction of a new barrel material, polypropylene, and a new type hanger for belt-driven cylinders that allows the operator to replace worn belts by merely snapping the old belt off its pulley and snapping a new one in its place, have been introduced by Hanson-Van Winkle-Munning Company.

The new type hanger leaves the belt pulleys totally exposed and easily accessible. The new pulley arrangement, however, does not impair the standard feature of all H-VW-M barrels, that of keeping all bearings free from contact with hot corrosive solutions.

The Mercil-type polypropylene barrel is one-piece moulded, ribless, and has all heat welded joints reinforced with stainless steel screws. Panels are ½ in. and perforated to suit customers' specifications. Inside surfaces are convex to add strength and facilitate tumbling. Polypropylene can withstand plating, cleaning or acid dipping solutions at temperatures up to 200° F.

Producing Special Sizes in Sheet

RECENTLY installed at the main factory of the Ayrshire Dockyard Co. Ltd., Irvine, an Ungerer 17-roll leveller and flying shear cut-up line will enable the company to produce its own special sheet sizes in both steel and aluminium.

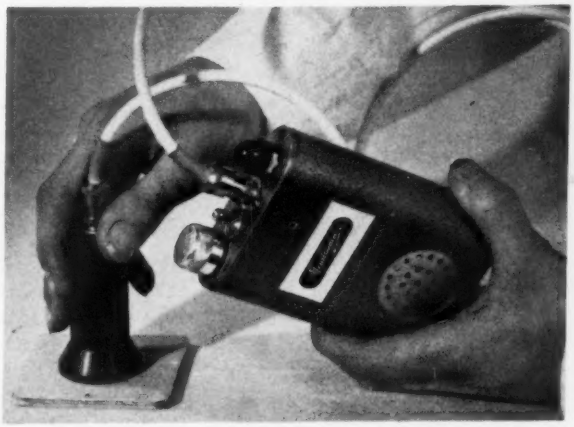
Two adjustable expanding drum type decoilers are used, one each for steel and aluminium. This arrangement takes care of the normal range of core diameter variation as received from the mills.

The two decoilers are situated a suitable distance from the entry side of the leveller to accommodate already cut flat sheets for an additional levelling pass if required.

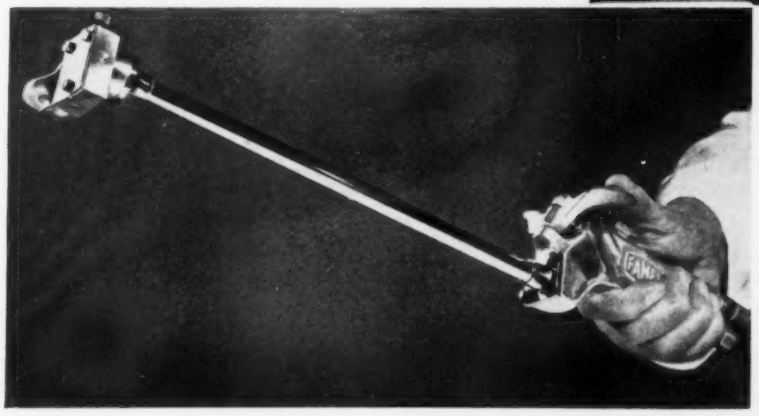
Sheets are cut to length by a reciprocating high-speed guillotine, electrically controlled by a trigger mechanism engaged by the leading edge of the sheet. The guillotine is accelerated horizontally to a speed synchronized with the rate of feed of the sheet, the cut made, and the guillotine returned to the stand-by position, all in one operation.

Cutting to length is accomplished without interruption to the flow of sheet, and the elimination of the more usual hump table results in a more compact layout and an improved flatness of cut sheet.

The line is designed to produce flat sheets from 3 ft. 6 in. up to 16 ft. in length, and up to 50 in. wide, in 26-12 g. mild steel, and 20-10 g. aluminium.



Metallization audio thickness gauge for checking thickness of metal sprayed coatings



Above: Ungerer 17-roll leveller and flying shear cut-up line at Ayrshire Dockyard Co. Ltd.

Left: A "Fame" hand spray gun with a single-facing head for cleaning and lubricating dies

SUCCESSFUL JOINTS IN TWO PASSES IN TWO-INCH MATERIAL

Welding Thick Aluminium Plate

TWO-PASS welding with full penetration and high weld quality in 2 in. 5083 alloy plate, utilizing automatic inert gas-metal arc (MIG) welding equipment has been accomplished by the Department of Metallurgical Research of Kaiser Aluminum and Chemical Corporation. Basic welding equipment changes and proper joint design are desirable for successful two-pass welding of the heavier plate thicknesses.

This welding development may extend the thickness range which can be production-welded in two passes using automatic MIG welding equipment with $\frac{1}{8}$ in. filler wire from the present $1\frac{1}{4}$ in. thickness to 2 in. Under conventional welding practice, up to 12 weld passes are required to weld 2 in. aluminium plate.

With two-pass welding it was found possible to reduce welding arc time and the amount of shielding gas used by about 50 per cent. In addition, the amount of edge preparation is minimized and smaller quantities of filler wire are required. As a result, the cost savings per foot of weld are substantial.

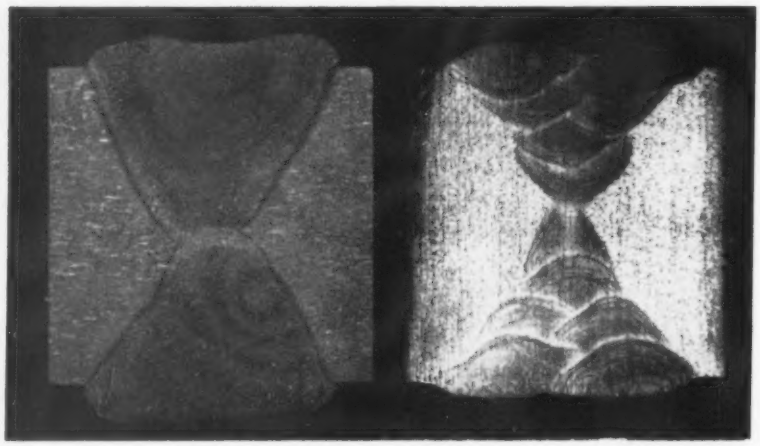
Utilization of the two-pass method can provide substantial overall savings in fabrication where extensive welding of heavy plate is required, particularly in pressure vessel, shipbuilding, ordnance and related applications.

Mechanical properties of two-pass weldments were found to be comparable to those for the same thickness welded by the multi-pass method. The two-pass technique is applicable to both butt and fillet welds but, because of the large molten weld pool created, the process can be used only in the flat or down-hand welding position.

Although in plate thicknesses up to at least $1\frac{1}{4}$ in. it is possible to use square butt joint designs, it was found better to bevel the edges of a joint in heavier sections to obtain full weld penetration and satisfactory bead crown. Correct alignment between the welding arc and joint is essential.

High current density welding utilizes higher voltages and amperages than customary. Multi-pass MIG welding with $\frac{1}{8}$ in. diameter filler and argon gas is usually done at currents below 300 amp and 30 V. In the Kaiser Aluminum investigations, currents up to 450 amp and 40 V were employed, with modified, automatic MIG welding equipment.

Greater penetration was obtained by increasing the wire feed rate until the greater portion of the welding arc was below the level of the plate surface. This technique did not result in a marked decrease in arc length, and the arc exhibited a deep penetrating action. As penetration is a function of current, with modified MIG equipment it was possible to increase the welding current up to 450 amp, with $\frac{1}{8}$ in. wire, in the laboratory, although 400 amp is at present considered the practicable limit for this size filler in shop production.



Cross-section (left) of a two-pass weld in 2 in. 5083-H113 plate made with $\frac{1}{8}$ in. diameter 5183 filler wire. At right is a cross-section of a 2 in. plate welded by conventional MIG methods with 12 passes

In addition to having adequate mechanical properties to meet A.S.M.E. pressure vessel code minimum strength requirements, the two-pass welds met the side bend requirements of the code, which calls for a 180° bend around the 2T radius with no defects of any kind. The bend test is quite sensitive to weld defects, but no bend difficulties were encountered because the two-pass welds were free from porosity and dross.

The high quality of the two-pass welds is believed to be due to three factors: (1) The high current density produces a finer spray transfer of molten aluminium from the filler wire to the weld pool. (2) The weld pool is large and molten for a longer period, and thus allows porosity-forming gases and oxide particles to escape from the weld pool more completely. (3) The fewer weld passes and less metal required than in conventional MIG welding reduces the chances of defects caused by contamination.

Machining High-Nickel Alloys

AS an aid to fabricators who undertake machining operations, Henry Wiggin and Company Limited have produced both a publication and a film on the machining of their high-nickel alloys.

Machinability is a function of mechanical properties, and it is only to be expected that materials with the combination of high strength and ductility which is characteristic of these high-nickel alloys should call for a machining procedure differing in detail from that applied to metals and alloys with lesser properties.

The film deals in turn with sawing, abrasive wheel cutting, fusion cutting, turning, boring, milling, drilling, tapping, broaching, precision grinding, thread cutting, thread rolling and spark erosion. Tool geometry, speed of cutting and choice of coolant are also dealt with.

Copies of the film (16 mm. colour and sound) can be supplied on loan to engineering societies and to industrial concerns.

The publication ("Machining Wiggin High-Nickel Alloys", Serial Number 1941) is also available free from the company at Thames House, Millbank, London, S.W.1.

Metallographic Specimens

FOR some time past, lecturers concerned with the teaching of metallurgy have needed a supply of micro-specimens of known composition and structure. Metallurgical Services, of Reliant Works, Betchworth, Surrey, have now produced a collection of annotated metallographic specimens comprising, at present 139 individual specimens of various ferrous and non-ferrous alloys. Notes with specimens give full details of their structures and of suitable methods of preparation. The specimens are also being used as standard reference specimens.

Industrial News

Home and Overseas

A New Division

In addition to the three divisions of their company which they at present operate, **Diversey (U.K.) Limited,** makers of specialized chemicals, will, as from February 1 next, add a metal industries division, which will handle the company's range of materials for the preparation of metals prior to further processing.

These compounds are used in the pre-treatment of aluminium alloys, particularly as a preparation for spot welding, anodizing, conversion coating, electroplating, lacquering and vitreous enamelling.

Mr. J. L. Edwards, who has specialized in metals pre-treatment with the Diversey Corporation (Canada) Limited, will lead this new division. The division will start by offering a range of seven products: Aluminux numbers 17, 202, 514, 519, 600 and 808, several of which are of special interest to the aircraft industry. Number 514 has been used for smut removal, prior to anodizing, on the metal used in some of the largest buildings in the U.S.A.

A Film Show

Under the auspices of the **Birmingham Productivity Association,** a film show is to be held at the West End Cinema, Suffolk Street, Birmingham, on Tuesday, February 7, when three films will be presented as follows:—"People Have Ideas"; "Plan Your Maintenance", and "Dispute".

The object of this event is to bring to notice some of the film material which is available and how it can be applied in the drive for increased productivity. These films are only three of many similar films which can be obtained on loan, at a moderate cost, from the Central Film Library, Government Building, Bromyard Avenue, Acton, London, W.3.

Birmingham industrialists are invited to attend the showing of these films, which will run continuously from 10.30 a.m. until 4.30 p.m. Tickets of admission, which is free, may be obtained from the Birmingham Productivity Association, Chamber of Commerce House, 75 Harborne Road, Edgbaston, Birmingham, 15.

Tin Council Statistics

Statistics issued by the **International Tin Council** last week show that in last November mine production of tin-in-concentrates rose in Thailand to 1,044 tons, against 1,018 tons in October, but fell in the Federation of Malaya to 4,518 from 4,720, and fell also in Indonesia—1,947 against 2,049—and in Nigeria—655 against 737 tons.

Exports of tin-in-concentrates from Bolivia climbed to 1,480 from 1,147. Imports of tin-in-concentrates into Malaya and Singapore fell to 1,819 from a revised 2,111 tons. In October, imports of tin-in-concentrates in the United States rose to 1,001 tons from 929 in September. December imports of tin-in-concentrates into the United Kingdom amounted to 2,338 again 2,000 tons in November.

Smelter output of tin metal in Malaya and Singapore in November came to 6,772, against 6,858 in October, while December production in the United Kingdom was 2,396, against November's 2,408 tons.

Exports of tin metal from Malaya and Singapore in December amounted to a provisional 7,745 tons, against 7,375 in November, while Malayan and Singapore tin exports for the whole of 1960 came to approximately 76,326 tons, compared with 44,671 tons in 1959.

In November, exports of tin metal from the United Kingdom fell to 328, from 515 in October, and in the Netherlands to 556 from 717.

Imports of tin metal into the United States amounted in October to 3,262, against 2,872 in September, while imports into Western Germany in October came to 2,753, against 2,947 in September.

Instrumentation

A photo-electric device which will give warning of the slowing down or stoppage of machinery used in continuous processes is now being produced by **Hird-Brown Limited.** The device, which can sense changes in rotation and other movement, is particularly useful where machinery is left unattended, and can monitor many types of machinery, including conveyors, rotating shafts, fans, rollers, press rolls, reciprocating shafts, levers and crank arms. The unit is dust-tight for use in industrial conditions.

As there are no "make and break" contacts nor any mechanical connection with the monitored drive, installation is extremely simple and no load is imposed on the drive. The unit is, therefore, intrinsically reliable but it has also been designed to fail safe and to give an alarm should there be any component failure.

The device is operated by repeated regular interruptions of a light beam which maintain a relay energized. Should the interruptions fall below a pre-determined speed or stop with the light beam broken or unbroken, the relay will give an alarm or initiate correction. Magnetic, as well as photo-electric, sensing heads are also available.

Plant Control

It is announced by **Elliott-Automation Limited** that the development of the automatic process plant control equipment, which is referred to in the Report of the National Research Development Corporation, is being carried out in the Data Processing Research Laboratories of the company. The project has been given the code name ARCH, which stands for automatic register controlled hierarchy.

The ultimate aim is to bring advanced automation projects within the reach of small manufacturers and also to enable the introduction of automation into industry generally to be carried out step by step. In this way, manufacturers may be encouraged to try out inexpensively the effect of the application of computing techniques to their particular processes.

The intention is to produce and market a range of basic electronic devices which can be assembled into many different systems to control plant and processes of many different types. Development is still in its early stages.

Miniature Gauges

A range of two-stage regulators marketed by **The British Oxygen Company Ltd.** is now being supplied fitted with a new series of miniature pressure gauges. More compact and robust, the new gauges have taper thread stems which are said to reduce risk of leaks and breakage.

The miniature gauges are calibrated with both British and metric markings and can be used with most of the principal industrial gases, including oxygen, acetylene, hydrogen, coal-gas, propane, nitrogen and air. These two-stage regulators are designed to ensure a constant gas outlet pressure regardless of the fall in cylinder pressure during use.

Seven-ton Vacuum Arc Melting Furnace

It is reported that Thos. Firth and John Brown Ltd. have placed an order with W. C. Heraeus G.m.b.H. Hanau, through their United Kingdom agents, **Fleischmann (London) Limited,** for a vacuum arc melting furnace for melting steel ingots up to 7 tons. The furnace is to be used for remelting steel electrodes under vacuum, the electrodes being cast by conventional methods.

Information Sheets

First of a new series of data sheets has been issued by **CIBA (A.R.L) Limited,** on "Aeroweb" aluminium honeycomb core materials for lightweight structures. This sheet, known as Production Information Sheet No. 1, gives the maximum allowable pressures for bonding various types of Aeroweb core between skins.

Tin Buffer Stock

According to a press communique issued by the chairman of the **International Tin Council,** the amount of tin held in the buffer stock of the Council at September 30 last was 10,030 tons. This amount is identical with that at March 31 and June 30 last year.

Price Reductions

It has been announced by the **Kenilworth Manufacturing Company Limited** that price reductions ranging from 10 to 20 per cent, affecting a number of their products, have been made possible by a recent fall in resin prices, and by increased sales which have, in turn, lowered production costs.

The reductions apply to the Hermetal double bond range of epoxy formulations used as structural adhesives and to the D.B. Toolform range of tooling compounds. A number of compounds have also been reformulated to give improved performance and application properties, and new compositions have been introduced to meet specific needs.

Park Gate Development

In October last, **Tube Investments Ltd.** announced a scheme by their subsidiary, The Park Gate Iron and Steel Company Ltd., for the development of a new integrated works on a site adjacent to the existing Park Gate works near Rotherham. The aim was to bring the new works into operation early in 1964.

It has now been decided that the development should be phased to make use of the group's existing supplies of cold pig iron for the time being. Initially, the new works will include the steel-making department, the blooming mill, followed by a continuous billet mill and, on the finishing side, the continuous narrow strip mill.

An aluminium scaffold staging unit assembled ready for use

Aluminium Scaffold Staging Unit

Scaffolding in all its various forms represents a type of temporary structure which must be capable of rapid assembly and dismantling, and which must involve in these processes minimum problems in handling. For this reason, aluminium alloy, despite a premium on first cost, has for many years found wide favour for scaffolding. Quite recently, an extension of this application has been developed by Martin Thomas Ltd., of Middlesex, who have put on the market their "High-Way" mobile staging units, designed and built mainly of aluminium alloy tubing supplied by **The British Aluminium Co. Ltd.** The weight of a single staging unit is well under 2 cwt.; 30 such units weigh approximately 2½ tons. Low weights of this order mean not only ease in erecting a tall assembly, but also, because of the low loading involved, minimum stressing of lower units as additional units are placed upon them.

The "cleanliness" of this aluminium alloy tube is appreciated quite as much as its light weight by those responsible for assembling the units on site and improves working conditions considerably. For interior use, especially when the staging has to be assembled in public buildings (perhaps over carpeting and fixed seating), the use of aluminium ensures that no harmful rust deposits can be shaken down to cause unsightly staining or subsequently to call for systematic and costly cleaning.

Visitors from Germany

Ten areas sales representatives of Croda G.m.b.H., Düsseldorf, recently paid a five-day visit to this country. The Düsseldorf firm is a wholly-owned subsidiary of the **Croda Organisation Limited,** which itself is the parent company of a world-wide group, the principal operating subsidiary of which is Croda Limited.

The purpose of the visit of the German representatives was to witness the manufacture and sale of Croda products in the U.K. in order to better tackle the German market. The ten visitors cover the whole of Western Germany and West Berlin, and the visit was made on the basis that the information so learned will enable them to tackle this difficult market more readily.

Scottish News

Further details have been given of the **Bertram and Son Ltd.** project at Hayfield, Fife. Their Kirkcaldy subsidiary, Melville Brodie Engineering Co. Ltd., will locate heavy engineering shops, an iron and brass foundry, storage yards and other facilities on an 18 acre site on the industrial estate. An immediate start is to be made on the design and construction of the first stage of the project.

Copper on Show

Telecommunications, chosen by the organizers as the special feature for this year's Electrical Engineers' Exhibition, is one in which copper plays a very important role. On the stand of the **Copper Development Association,** therefore, will be displayed examples of some of the many types of copper conductors used for telecommunication, both on land and for undersea intercontinental services.

The many copper alloys which are also used for innumerable special applications throughout the electrical industry will be represented by a range of typical components. One aspect of the association's service to industry is exemplified by the many C.D.A. publications, which may be obtained free upon application and which can be inspected on the stand during the exhibition. The stand number is L.11.

Trade with Hungary

By mutual agreement between the Board of Trade and the Hungarian Ministry of Foreign Trade, the quotas for trade between the two countries has been extended on a proportionate basis for three months as from Friday of last week (January 27), when these quotas would have normally expired.

The purpose of this arrangement is to avoid interruption of trade between the two countries pending the completion of negotiations about trade quotas on both sides for the 12 months from January 27, 1961. Licences issued under this interim arrangement will be debited against the quotas finally established for that period.

Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell 33 tons to 10,007 tons, comprising London 4,262, Liverpool 3,915, and Hull 1,830 tons.

Copper stocks rose 540 tons to 15,860, distributed as follows: London 1,500, Liverpool 11,610, Birmingham 400, Manchester 2,300, and Swansea and Hull 50 tons.

Lead duty-free stocks rose 89 tons to 6,736, but in-bond stocks remained unchanged at 3,917 tons. All these supplies were lying in London.

Zinc duty-free stocks rose 723 tons to 2,802 tons, but in-bond stocks fell 25 tons to 575 tons. London stocks comprised 1,519 tons duty free, and 575 in bond, Liverpool 1,233 and nil, and Glasgow 50 and nil respectively.

Powder Metallurgy Congress

The Fourth International Powder Metallurgy Congress would be held in Reutte, Tyrol, Austria, from June 20-24, 1961, it was announced by Dr. Paul Schwarzkopf, chairman of the Congress, President of the Metallwerk Plansee in Reutte and of the Schwarzkopf Development Corporation. Among the 37 participating nations will be a large delegation from the United States, with delegates from leading industrial corporations, from various United States Government Agencies and from scientific institutions. The topic of the Congress will be "Powder Metallurgy in the Nuclear Age".

In the House

At Question Time in the House of Commons on Monday, Mr. Hornby (Member for Tonbridge) asked the Minister of Labour whether he had considered the recommendations contained in the Industrial Training Council's Report on the problems of school-leavers in certain areas; and what action he proposed to take.

In his reply, Mr. John Hare (Minister of Labour) said:—"Yes, Sir. After consulting the National Youth Employment Council I have decided to widen the Training Allowances Scheme from 1st March. Instead of being confined to apprenticeships or training of similar standard in skilled industrial occupations, the scheme from that date will also cover jobs where the employer undertakes to provide planned practical training for at least four months and those which offer stable employment with an acknowledged avenue of advancement to more responsible work. The other recommendations in the Council's report are under consideration".

It is understood that there is no fixed weekly allowance but payment is based on the amount by which an applicant's approved expenses exceed his income. The expenses taken into account are board and lodging, midday meals, laundry and pocket money—all up to certain

allowable limits—plus daily fares between lodgings and work if the lodgings are more than two miles away and fares or transport are not provided by the employment. Income includes wages and other payments, parents' contributions on a scale assessment, and employers' contributions (if any). Other benefits include a free fare to take up employment, return fares in excess of 7s. 6d. for journeys home three times a year, and special allowances in sickness and certain other emergencies.

U.S. Lead and Zinc

Various segments of the U.S. domestic lead-zinc industry have resolved their differences and will back new legislation designed to aid the industry, according to the *American Metal Market*. The proposed legislation, known as the "Lead-Zinc Act of 1961" would provide for limited subsidiary payments to small mines, an import tax on metal and concentrates, and a "compensatory" tax on foreign-trade manufactured products of either metal coming into this country. The legislation was introduced last Friday by House Interior Committee Chairman, Mr. Wayne Aspinall of Colorado.

The Bill provides for an import tax on lead and zinc concentrates and metal consisting of: first, a permanent tax of 2 cents per lb. on lead and zinc metal and 1·4 cents per lb. on ores and concentrates to assure minimum required domestic prices and, second, a removable tax of the same amount on both metals which is applied if the domestic market price of either metal goes below 13½ cents per lb. and is removed when the market prices rise above 14½ cents per lb.

The legislation also provides for a compensatory tax on the lead and zinc content of imported manufactured goods. This is 2 cents per lb. in addition to present levies, with an increased amount on two zinc items.

Indian Copper Production

Production of copper ore during January/November 1960 was 407,854 tons, according to the Indian Bureau of Mines. This represents an increase of about 9 per cent compared to the output of 373,078 tons in the corresponding period of the preceding year. Production of copper metal during January/November 1960 was 8,161 tons, compared to 7,303 tons in the corresponding period of 1959.

Japanese Aluminium

Japanese production of primary aluminium in 1960 amounted to 131,239 tons, according to the Japan Light Metal Association. This was a 32·4 per cent increase over the 1959 production figure. Most of the 1960 production was absorbed by domestic consumers, with deliveries to local industries totalling 126,130 tons. Year-end stocks amounted to about 6,552 tons, the Association added.

Industrial Design

Following its two successful design appreciation courses for junior engineers, the **Council of Industrial Design** is organizing a course for senior engineers. It will be held from April 25-28 inclusive and should not, of course, be confused with the third junior course, which finishes early in April. The senior course will have three main aims—to impart an appreciation of design in its widest context, to show how industrial design can be put into practice, and to emphasize the growing application of industrial design in engineering today.

Particular attention will be paid to organizational questions, as well as to general design appreciation, so the course should be of special interest to senior engineering staff with executive control or responsibility for engineering design teams.

Lectures in the first part of the course will deal with the development of industrial design and with analyses of the factors which constitute good design, with special reference both to the part played by form, colour and composition and to human engineering or ergonomic aspects.

In the second part of the course, talks on design organization directed towards using industrial design to the best advantage will be held with a leading manufacturer, a leading industrial designer and representatives of the College of Industrial Design. The course will be held in London and will be residential so as to make the fullest use of available time and encourage group discussion.

Cybernetics Congress

Advance notice is given of the Third International Congress on Cybernetics, organized by the **International Association for Cybernetics,** which is to be held at Namur, Belgium, from September 11 to 15 this year.

The programme for this event has been arranged in five sections as follows:—(1) principles and methods of cybernetics; (2) semantic machines; (3) automation: technical aspects; (4) automation: economics and social aspects; and (5) cybernetics and life.

Full details of this congress may be obtained from the secretary, "Association Internationale de Cybernetique", rue Basse-Marcelle, 13, Namur, Belgium.

Order from Switzerland

It is reported that **Davy and United Engineering Company** has secured a contract, valued at £500,000, for the construction of an aluminium plate mill for Aluminium-Industrie, of Switzerland, at its Chippis works. It is said that the new mill will be capable of producing aluminium plate up to 7 ft. 6 in. wide and of ¼ in. thickness.

New Rack Clamp

A revolutionary new type of clamp, the Carver rack clamp, has recently been introduced by **Carver and Company (Engineers) Limited**. This clamp, which works on the simple rack adjustment principle, is said to represent a great advance in clamping since the invention of the "G" clamp. Originally designed for use in welding, it has since been found capable of performing many other clamping operations quickly and efficiently, and it has also been approved by the Council of Industrial Design for inclusion in "Design Index".

Among the advantages claimed for this tool are its short shielded screw, which gives a powerful grip without distorting the clamp; the shield protects the screw from weld spatter damage, and the heat-treated cadmium plated castings are resistant to rusting. Limited movement of the jaw pad gives secure grip on odd shapes, such as rounds to flat surfaces; two thin sheets of material can be clamped securely together as easily as two large objects occupying the full capacity.

The clamp is also compact, and can be operated in reverse as a jack as well as a wrench. There is a choice of three models, one with 6 in. capacity, another with a 12 in. capacity, and a heavy duty model.

A Golden Jubilee

Founded in 1911, **The Carborundum Company Limited** marks up its 50th birthday this year and during its existence has grown into one of the leading industrial companies in this country. Manufacturers of abrasive grains, bonded abrasive products, coated abrasive products, super refractories, and ceramic cutting tools, the company has found for itself an authoritative position in this field of British industry.

Forthcoming Meetings

February 5—Institute of Metals. Oxford Local Section. Cadena Café, Cornmarket Street, Oxford. "New Aspects of the Electron Theory of Metals." Dr. V. Heine. 7.15 p.m.

February 6—Institute of British Foundrymen. Sheffield Branch. Technical College, Pond Street, Sheffield. "Some Practical Experiences in Making Moulds in a Mechanized Foundry." H. Pinchin. 7 p.m.

February 7—Institute of Metals. South Wales Local Section. Metallurgy Department, University College, Singleton Park, Swansea. "Inspection of the High Strength Wrought Aluminium Alloys." W. Smitham. 6.30 p.m.

February 7—Leeds Metallurgical Society. Metropole Hotel, Leeds. "Metals in Antiquity." Dr. R. F. Tylecote. 6.30 p.m.

February 7 — Institution of Production Engineers. Coventry Graduate Section. Courtaulds Lecture Theatre, Lockhurst Lane, Coventry. "Automatic Equipment in the Metal Finishing Industry." S. H. Grindrod. 7.30 p.m.

February 7 — Society of Chemical Industry. Corrosion Group. Midlands Branch. Engineering Centre, Stephenson Place, Birmingham. Short Papers Evening.

February 7 — Institution of Plant Engineers. Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2. "Standards in Plant Engineering." Dr. E. L. Diamond. 6.30 p.m.

February 7—Institute of Metal Finishing. Midland Branch. James Watt Memorial Institute, Great Charles Street, Birmingham, 3. Brains Trust on Precleaning, Rinsing and Drying. 6.30 p.m.

February 8—Institute of Metal Finishing. Organic Finishing Group. British Institute of Management, 80 Fetter Lane, London, E.C.4. "Paints and Painting in the Sixties." E. Johnson. 6.30 p.m.

February 8 — Manchester Metallurgical Society. Manchester Literary and Philosophical Society, Geoge Street, Manchester. "Residual Stress and Stress Relieving." Dr. L. E. Benson. 6.30 p.m.

February 9 — Liverpool Metallurgical Society. Department of Metallurgy, University of Liverpool. "The Origin and Solution of Some Industrial Corrosion Problems." E. C. Campbell. 7 p.m.

Metal Market News

THE non-ferrous metal situation in the United States continues to be disappointing, and the details of consumption, etc., for December have made a poor impression. Domestic usage of copper in December was, apparently, 81,167 tons against 107,057 tons in November, while new business in the month on the basis of copper content amounted to 90,904 tons, against 107,335 tons. Unfilled orders at the end of the month stood at 126,260 tons, compared with 116,523 tons a month earlier. A further report says that in 1960 apparent consumption in the United States was lower than in 1959 by about 6 per cent, but the new business booked by fabricators last year was 16 per cent lower than in 1959 In other directions, too, activity across the Atlantic is far from satisfactory, and hopes are being expressed that the new President will be able to galvanize the economy into greater activity than it at present enjoys. If Wall Street is any sort of a guide, then things ought to be on the mend shortly, for there has been a fairly good tone on the stock market this week. In London, too, there is a satisfactory measure of investment buying of equities, and advances have been seen.

The Metal Exchange now publishes week by week details of the warehouse stocks of all four metals, and on Monday last week the following details were issued: copper increased by 375 tons to 15,320 tons; tin 53 tons up, to 10,040 tons; lead plus 1,718 tons, to 10,564 tons; and, finally, zinc lagging well behind the others, with a gain of 195 tons to 2,679 tons. Business has been very quiet, and last week saw relatively small turnovers in Whittington Avenue. For example, about 9,150 tons of standard copper changed hands without Kerb dealing, which may well have amounted to another 1,000 tons. There were minor day to day fluctuations, but, on the whole, the price was very stable. The tendency was, however, downwards, for there are expectations that the custom smelters will be obliged to cut their price in the very near future. This reduction might well amount to a full cent, which would bring the smelters' quotation down to 27 cents. Finally, cash closed £2 5s. 0d. down at £217 15s. 0d., while three months lost £1 15s. 0d. to £218 10s. 0d. A satisfactory feature of the week's trading was the widening of the contango to 15s. With increasing stocks, the gap between cash and forward might well widen further.

Little change was seen in lead and zinc, but tin showed a firm front, and the advance, especially in cash, was not inconsiderable. The turnover was 1,005 tons, for trading was more active than usual. Finally, after a fairly steady advance, the close was £787 for cash, which showed a rise of £5 10s. 0d. over the previous Friday, while three months, at £789, was only £3 10s. 0d. up. It would seem that there is a certain amount of optimism in regard to the new Tin Agreement, which will be negotiated later on this year. In lead, the turnover amounted to about 6,300 tons, cash closing 5s. down at £63 15s. 0d., while three months lost 7s. 6d. at £64 17s. 6d. Zinc was quiet and featureless in its trading, with a turnover of 4,350 tons. At the close, cash was 2s. 6d. lower on balance at £79, while three months was unchanged at £78 17s. 6d.

Birmingham

The latest figures of the Ministry of Labour show that Midland unemployment has now reached 2 per cent. Decline in the motor trade and associated industries is largely responsible for the change which has come over the industrial position in the last few months. Another industry which reports shortage of work is that concerned with railway rolling stock. Local firms are nearing the end of contracts, both on home and overseas account, and very little new business is coming forward. Makers of metal pressings and fittings are, however, still doing a fair amount of work for the building trade. A cautious tone is evident in the market for raw material.

The supply position in steel is easier, except in heavy structural material, where customers still have to wait fairly long periods. Demand for sheets has declined, due to the much lower rate of output in the motor trade—estimated at less than 50 per cent capacity. The heavy rate of imports of steel sheet, as indicated by recent statistics of last year's trading, is not likely to be repeated unless there is a very early return to prosperity in the motor industry. Consumers of iron and steel generally are fairly well situated for stocks, and, in some quarters, are asking for deliveries against contracts to be curtailed. Machine tool makers are still busy. There is also a brisk business in agricultural tractors and commercial vehicles.

New York

Copper futures were steady in moderate dealings at the week-end. Physical copper was mostly quiet. Most dealers and custom smelters indicated quiet conditions. A leading custom smelter said export sales were moderate around 27 cents c.i.f. Only routine business was reported in producer copper. Tin was firmer, following the advance abroad, but quiet. Moderate sales on the average price basis were reported in lead and zinc. Scrap copper was quiet and steady. Trade sources said there were fair offerings of scrap copper.

Domestic consumption of copper by brass and wire mills and foundries, based on their shipments of fabricated products in December totalled 81,167 short tons, compared with 107,057 in November, according to the Copper Association.

New business booked by fabricators in terms of refined copper to be used totalled 90,904 (107,335). Unfilled orders on fabricators' books at the end of December totalled 126,260 (116,523). Fabricators' stocks of refined copper at the end of November amounted to 456,094 tons (446,098) and orders on hand with producers amounted to 75,222 (68,165). Fabricators' receipts from producers were 91,163 tons (99,749), and their gross reserves 531,316 (514,263). Fabricators' working stocks were 370,005 (369,977).

Paris

The use of copper tubing in central heating installations is reported to be making considerable headway in France and has resulted in a greater demand for copper.

French aluminium exports continue to progress. For the first six months of 1960, France exported 29,228 tons of aluminium ingots against 27,325 tons for the same period in 1959.

The production of organometallic products is growing. Ethyl Kuhlmann, in which The Associated Ethyl Co., of London, is interested, is building a plant for the production of lead tetramethylene and lead tetraethylene. Ethyl Kuhlmann, we believe, is the only company in France producing organometallic lead products.

Italy

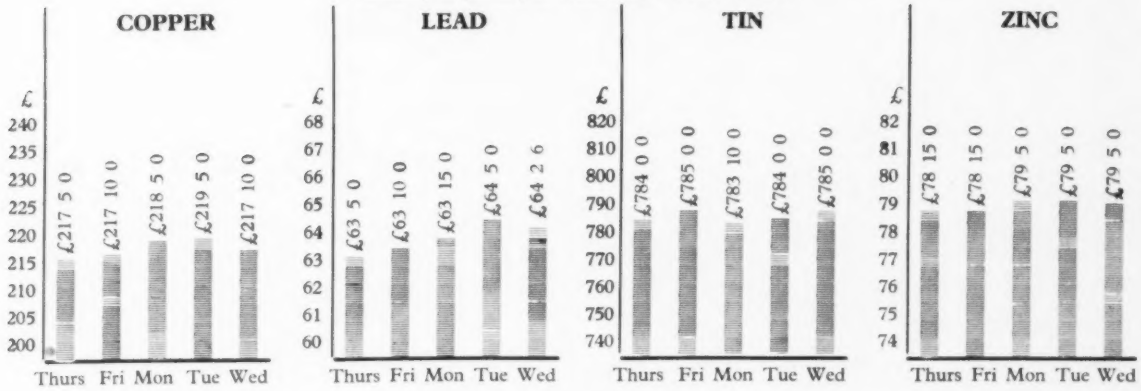
According to figures released by the Central Statistical Institute in Rome, Italian imports of crude copper for refining in the first ten months of 1960 were 12,293·7 metric tons, valued at 5,288,159,000 lire, of which 60·9 metric tons, valued at 25,016,000 lire, were imported temporarily. The principal suppliers were the Federation of Rhodesia and Nyasaland with 6,489·5 metric tons, South Africa with 2,935·9 and Chile with 1,610·6 metric tons.

Imports of refined copper in slabs, ingots, plates, etc., totalled 145,657·3 metric tons, valued at 59,715,392,000 lire, of which 17,077 metric tons, valued at 7,360,428,000 lire, were imported temporarily. The principal sources of supply were: Belgium/Luxembourg 4,158·6 metric tons; France 5,014·8; United Kingdom 8,945·5; ex-Belgian Congo 28,441·9; Rhodesia and Nyasaland 23,928·5; South Africa 7,351·9; Chile 23,823·0; and the United States 37,190·8 metric tons.

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 26 January to Wednesday 1 February 1961



Primary Metals

All prices quoted are those available at 2 p.m. 1/2/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	,,	217	10	0
Antimony Metal 99%	,,	210	0	0
Antimony Oxide Commercial	,,	194	10	0
Antimony White Oxide	,,	196	0	0
Arsenic	,,	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	,,		11	0
Calcium	,,	2	0	0
Cerium 99%	,,	15	0	0
Chromium	,,		6	11
Cobalt	,,		12	0
Columbite	per unit		—	
Copper H.C. Electro	ton	217	10	0
Fire Refined 99·70%	,,	216	0	0
Fire Refined 99·50%	,,	215	0	0

		£	s.	d.
Copper Sulphate	ton	76	0	0
Germanium	grm.		—	
Gold	oz.	12	12	4
Indium	,,		10	0
Iridium	,,	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	64	2	6
Magnesium Ingots	lb.			
99·8%	,,		2	2½
99·9 + %	,,		2	3
Notched Bar	,,		2	9½
Powder Grade 4	,,		6	1
Alloy Ingot, AZ91X		1	11¾-2	1¼
Manganese Metal	ton		—	
Mercury	flask	69	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	,,		5	6
Osmium	oz.		nom.	
Osmiridium	,,		nom.	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	,,	30	5	0
Rhodium	,,	46	0	0
Ruthenium	,,	16	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	7⅝
Tellurium Sticks	lb.	2	0	0
Tin	ton	785	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	,,		—	
Virgin Min 98%	,,	79	2	6
Dust 95/97%	,,	128	0	0
Dust 98/99%	,,	134	0	0
Granulated 99 + %	,,	104	2	6
Granulated 99·99 + %	,,	119	3	9

**Duty and Carriage to customers' works for buyers' account.*

Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg≏£/ton		**Canada** c/lb≏£/ton		**France** fr/kg≏£/ton		**Italy** lire/kg≏£/ton		**Switzerland** fr/kg≏£/ton		**United States** c/lb≏£/ton	
Aluminium			26.00	215 16	2.43	179 11	370	216 1	2.50	206 5	26.00	207 4
Antimony 99.0					2.30	170 0	495	286 3			29.00	231 2
Cadmium					15.75	1,069 0					150.00	1,195 10
Copper												
Crude							420	245 5				
Wire bars 99.9 Electrolytic	30.25	223 11	27.50	222 15	3.05	225 7			2.83	231 0	29.00	231 6
Lead			10.00	81 0	.94	69 9	163	95 3	.83	68 9	11.00	87 13
Magnesium												
Nickel			70.00	581 0	9.00	665 2	1,200	699 6	7.50	618 15	74.00	589 15
Tin	109.00	796 13			11.12	821 15	1,480	864 6	9.58	805 12	100.62	801 18
Zinc												
Prime western			12.00	99 12 0								
High grade 99.95			12.60	104 11 0								
High grade 99.99			13.00	107 18 0					1.10	92 10		
Thermic					1.20	88 13						
Electrolytic					1.28	94 13	181	105 14			13.00	104 0

Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 1 2 61

	£	s.	d.
Aluminium Alloy (Virgin)			
B.S. 1490 L.M.5 .... ton	210	0	0
B.S. 1490 L.M.6 .... „	202	0	0
B.S. 1490 L.M.7 .... „	216	0	0
B.S. 1490 L.M.8 .... „	203	0	0
B.S. 1490 L.M.9 .... „	203	0	0
B.S. 1490 L.M.10 .... „	221	0	0
B.S. 1490 L.M.11 .... „	215	0	0
B.S. 1490 L.M.12 .... „	223	0	0
B.S. 1490 L.M.13 .... „	216	0	0
B.S. 1490 L.M.14 .... „	224	0	0
B.S. 1490 L.M.15 .... „	210	0	0
B.S. 1490 L.M.16 .... „	206	0	0
B.S. 1490 L.M.18 .... „	203	0	0
B.S. 1490 L.M.22 .... „	210	0	0
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 .... ton	171	0	0
B.S. 1490 L.M.2 .... „	174	0	0
B.S. 1490 L.M.4 .... „	183	0	0
B.S. 1490 L.M.6 .... „	183	0	0
***Aluminium Bronze**			
BSS 1400 AB.1 ..... ton	241	0	0
BSS 1400 AB.2 ..... „	249	0	0

	£	s.	d.
***Brass**			
BSS 1400-B3 65/35 .. ton	172	0	0
BSS 249 ..... „	—		
BSS 1400-B6 85/15 .. „	217	0	0
***Gunmetal**			
R.C.H. 3/4% ton .... „	—		
(85/5/5/5) LG2 ..... „	214	0	0
(86/7/5/2) LG3 ..... „	223	0	0
(88/10/2/1) ..... „	276	0	0
(88/10/2/½) ..... „	286	0	0
***Manganese Bronze**			
BSS 1400 HTB1 ..... „	192	0	0
BSS 1400 HTB2 ..... „	209	0	0
BSS 1400 HTB3 ..... „	228	0	0
Nickel Silver			
Casting Quality 12% „	242	0	0
„ „ 16% „	263	0	0
„ „ 18% „	293	0	0
***Phosphor Bronze**			
B.S.1400P.B.1.(A.I.D. released) ..... „	304	0	0
B.S. 1400 L.P.B.1 „	235	0	0

**Average prices for the last week-end.*

	£	s.	d.
Phosphor Copper			
10% ..... ton	253	0	0
15% ..... „	255	0	0
Phosphor Tin			
5% ..... „	—		
Silicon Bronze			
BSS 1400-SB1 ..... „	275	0	0
Solder, soft, BSS 219			
Grade C Tinmans ... „	361	0	0
Grade D Plumbers .. „	289	0	0
Grade M ..... „	397	0	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.	—		
Type 9 „ „	—		
Zinc Alloys			
BSS 1004 Alloy A .. ton	112	13	9
BSS 1004 Alloy B .... „	116	13	9
Sodium-Zinc ..... lb.		2	6½

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			
Sheet 10 S.W.G. lb.	2	10½	
Sheet 18 S.W.G. „	3	0½	
Sheet 24 S.W.G. „	3	3½	
Strip 10 S.W.G. „	2	10½	
Strip 18 S.W.G. „	2	11½	
Strip 24 S.W.G. „	3	1	
Circles 22 S.W.G. „	3	4½	
Circles 18 S.W.G. „	3	3½	
Circles 12 S.W.G. „	3	2½	
Plate as rolled ..... „	2	10	
Sections ..... „	3	4	
Wire 10 S.W.G. .... „	3	1½	
Tubes 1 in o.d. 16 S.W.G. ..... „	4	4	
Aluminium Alloys			
BS1470. HS19W.			
Sheet 10 S.W.G. „	3	3	
Sheet 18 S.W.G. „	3	5½	
Sheet 24 S.W.G. „	4	1	
Strip 10 S.W.G. „	3	3	
Strip 18 S.W.G. „	3	4½	
Strip 24 S.W.G. „	4	0½	
BS1477. HP30M.			
Plate as rolled ..... „	3	1	
BS1470. HC15WP.			
Sheet 10 S.W.G. „	4	3	
Sheet 18 S.W.G. „	4	8½	
Sheet 24 S.W.G. „	5	8½	
Strip 10 S.W.G. „	4	4	
Strip 18 S.W.G. „	4	8½	
Strip 24 S.W.G. „	5	4½	
BS1477. HPC15WP.			
Plate heat treated ... „	3	10½	
BS1475. HG19W.			
Wire 10 S.W.G. „	4	2	
BS1471. HT19WP.			
Tubes 1 in. o.d. 16 S.W.G. ..... „	5	5	
BS1476. HE19WP.			
Sections ..... „	3	4	
Split tube			
19 S.W.G. (¼") ..... „	4	1	
20 S.W.G. (⅛") ..... „	3	10	
21 S.W.G. (⅛") ..... „	4	0	
22 S.W.G. (¼") ..... „	4	10	
Welded tube			
14 to 20 S.W.G. (sizes ½" to 1½") .... „	3/10 to 5/8		

Brass			
Tubes ..... lb.	1	9	
Brazed Tubes ..... „	3	0	
Drawn Strip Sections „	3	0	
Sheet ..... ton	191	0	0
Strip ..... „	191	0	0
Extruded Bar ..... lb.	1	11¾	
Condenser Plate (Yellow Metal) ..... ton	179	0	0
Condenser Plate (Naval Brass) ..... „	191	0	0
Wire ..... lb.	2	7⅛	
Beryllium Copper			
Strip ..... „	1	4	11
Rod ..... „	1	1	6
Wire ..... „	1	4	9
Copper			
Tubes ..... lb.	2	1¾	
Sheet ..... ton	251	0	0
Strip ..... „	251	0	0
H.C. Wire ..... „	269	15	0
Cupro Nickel			
Tubes 70/30 ..... lb.	3	5½	

Lead			
Pipes (London) ..... ton	104	0	0
Sheet (London) ..... „	101	15	0
Tellurium Lead ..... „	£6 extra		
Nickel Silver			
Sheet and Strip 10% .. lb.	3	9¾	
Wire 10% ..... „	4	2¾	
Phosphor Bronze			
Wire ..... „	3	11¾	
Titanium (1,000 lb. lots)			
Billet 4½" to 18" dia..... lb.	47/-	48/-	
Rod ½" to 4" dia..... „	85/-	53/-	
Wire ·036"-·232" dia..... „	159/-	99/-	
Strip ·001" to ·048" ..... „	350/-	68/-	
Sheet 8" × 2'. 20 gauge „	73/-		
Tube, representative average gauge ..... „	198/-		
Extrusions ..... „	90/-		
Zinc			
Sheet ..... ton	115	10	0
Strip ..... „	nom.		

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 31/1/61.

	£
Aluminium	
New Cuttings	139
Old Rolled	110
Segregated Turnings	74
Brass	
Cuttings	156
Rod Ends	139
Heavy Yellow	129
Light	124
Rolled	143
Collected Scrap	128
Turnings	132
Copper	
Wire	198
Firebox, cut up	195
Heavy	193
Light	190
Cuttings	200
Turnings	177
Braziery	172

	£
Gunmetal	
Gear Wheels	190
Admiralty	190
Commercial	176
Turnings	171
Lead	
Scrap	55
Nickel	
Cuttings	—
Anodes	555
Phosphor Bronze	
Scrap	176
Turnings	171
Zinc	
Remelted	71
Cuttings	59
Old Zinc	38

Financial News

M. Mole and Son

Dividend 11¼ per cent for 1960 (same). Profit £44,332 (£43,886), after tax £33,206 (£29,414). Add special credits £79 (£2,607).

Davy-Ashmore

It is understood that Davy-Ashmore is forming a subsidiary company under the title of Davy-Ashmore Export Company for the purpose of developing the overseas selling and engineering organization of the group and to promote extension of its export trade in capital goods. This expansion will be directed to the fields of metals, chemicals, petrochemical, gas, and petroleum engineering.

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

Wilfred Clark Limited (679250), 262 New John Street West, Hockley, Birmingham, 19. Registered December 30, 1960. To take over the business of manufacturers of wire and sheet metal handling and display trays carried on at Birmingham as "Wilfred Clark", etc. Nominal capital, £10,000 in £1 shares. Directors: Wilfred Clark, Geoffrey D. Clark and Mrs. Dorothy E. Clark.

Artrow Metals Co Limited (679413), Sandywood Lane, Cheslyn Hay, near Walsall. Registered January 2, 1961. To take over the business of dealers in scrap metals carried on as "Artrow Metals and Pressings Co." at Cheslyn Hay, near Walsall, etc. Nominal capital, £3,000 in £1 shares. Permanent directors: Arthur Johnson, Marion Johnson and Joseph Z. Johnson.

Morganite Carbon Limited (679647), Battersea Works, Battersea Church Road, S.W.11. Registered January 4, 1961. To carry on business of manufacturers of and dealers in accessories, components and equipment for the electrical and other trades, etc. Nominal capital, £100 in £1 shares. Directors: Patrick A. L. Brewer, James Cunningham, Frances K. Earp, Andrew W. Edward, Colin S. Harris, Hay I. Matthey, John Walker, Ian W. Smith and John S. Woods.

Morganite Crucible Limited (679648), Norton Works, Woodbury Lane, Norton, Worcs. Registered January 4, 1961. To carry on business of manufacturers of and dealers in crucibles, etc. Nominal capital, £100 in £1 shares. Directors: Alan D. Boydell, Dixon Scott, Wm. H. Crawshaw, A. W. Edward, Hay I. Ingram, Denis S. S. Thynne, Roger G. J. van Hertsen, John Walker and Ian W. Smith.

Morganite Electroheat Limited (679649), Wandsworth Works, Northfields, S.W.18. Registered January 4, 1961. To carry on business of electrical, mechanical and constructional engineers and consultants, etc. Nominal capital, £100 in £1 shares. Directors: John H. Dawson, John W. Evans, Andrew W. Edwards, Edgar W. Hale, Leonard Hallewell, Hay I. Ingram, John Walker and Ian W. Smith.

Morganite Research and Development Limited (679650), 52 Battersea Church Road, S.W.11. Registered January 4, 1961. Nominal capital, £100 in £1 shares. Directors: Andrew W. Edwards, Hay I. Matthey and John Walker.

Ingot Casting Machines Ltd. (679528), 14 Temple Street, Birmingham, 2. Registered January 3, 1961. Nominal capital, £2,000 in £1 shares. Directors: Thos. D. Ambrose and Eric J. Ponting.

Precision Press Brakes Ltd. (680198), Mucklow Hill, Halesowen, Worcs. Registered January 10, 1961. To carry on business of press brake products, etc. Nominal capital, £6,000 in £1 shares. Directors: Graham D. Hopkinson, James C. Lees, Frederick A. G. Clement, Norman A. Tye and Ernest W. L. Tye.

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

France (new francs per kilo):

Electrolytic copper scrap	(£218.0.0)	2.95
Heavy copper	(£218.0.0)	2.95
No. 1 copper wire	(£206.18.0)	2.80
Brass rod ends	(£160.7.0)	2.17
Zinc castings	(£63.11.0)	0.86
Lead	(£61.6.0)	0.83
Aluminium	(£136.14.0)	1.85

Italy (lire per kilo):

Aluminium soft sheet clippings (new)	(£178.2.0)	305
Lead, soft, first quality	(£79.8.0)	136
Lead, battery plates	(£43.16.0)	75
Copper, first grade	(£207.6.0)	355
Bronze, commercial gunmetal	(£169.1.0)	290
Brass, heavy	(£140.3.0)	240
Brass, light	(£125.11.0)	215
Brass, bar turnings	(£143.1.0)	245
Old zinc	(£57.4.0)	98

Japan (Yen per metric ton):

Electrolytic copper	(£—)	275,000
Copper wire No. 1	(£—)	255,000
Copper wire No. 2	(£—)	236,000
Heavy copper	(£—)	245,000
Light copper	(£—)	205,000
Brass, new cuttings	(£—)	187,000
Red brass scrap	(£—)	223,000

West Germany (D-marks per 100 kilos):

Used copper wire	(£195.1.0)	225
Heavy copper	(£190.14.0)	220
Light copper	(£173.8.0)	200
Heavy brass	(£125.14.0)	145
Light brass	(£86.14.0)	105
Soft lead scrap	(£50.5.0)	58
Zinc scrap	(£47.13.0)	55
Used aluminium unsorted	(£78.1.0)	90

Light Metal Statistics

Figures showing the U.K. production, etc., of light metals for Sept. 1960, have been issued by the Ministry of Supply as follows (in long tons):—

Virgin Aluminium	
Production	1,842
Imports	22,199
Despatches to consumers	26,542
Secondary Aluminium	
Production	10,918
Virgin content of above	1,533
Despatches (including virgin content)	10,827
Scrap	
Arisings	15,561
Estimated quantity of metal recoverable	11,532
Consumption by:	
(a) Secondary smelters	12,381
(b) Other uses	1,505
Despatches of wrought and cast products	
Sheet, strip and circles	14,421
Extrusions (excluding forging bar, wire-drawing rod and tube shell):	
(a) Bars and sections	3,917
(b) Tubes (i) extruded	437
(ii) cold drawn	647
(iii) formed strip	—
(c) (i) Wire	1,416
(ii) Hot rolled rod (not included in (c) (i)	30
Forgings	360
Castings: (a) Sand	1,667
(b) Gravity die	4,967
(c) Pressure die	2,476
Foil	2,318
Paste	304
Magnesium Fabrication	
Sheet and strip	12
Extrusions	93
Castings	203
Forgings	13

LIGHT METALS STATISTICS IN JAPAN
(Oct. 1960)

Classification	Production	Shipment	Stock	Export
Alumina	33,321	24,752	18,805	0
Super purity Al	175	81	506	0
Primary Al	12,153	11,152	7,219	0
Secondary Al	4,606	4,563	634	0
Wrought products (Al and its alloy)	11,670	—	—	—
Plate, sheet and strip	8,197	8,316	2,431	0
Foil	802	847	289	738
Rolled and extruded shape	1,609	1,634	229	—
Forgings	38	—	—	—
Electric wire	1,024	1,213	129	222
Powder, flake and paste	—	—	—	—
Casting	5,825	—	—	—
Sand and permanent mould	3,239	—	—	—
Die	2,586	—	—	—
Sheet products	2,205	2,411	1,697	77
Primary Mg	197	195	27	—
Secondary Mg	242	203	405	—
Mg casting	34	—	—	—
Sponge Ti	186	144	1,014	138
Super purity Al (Nov.)	171	97	580	—
Primary Al (Nov.)	11,567	11,576	7,208	0

THE STOCK EXCHANGE

New Account Opened In Firm Style

ISSUED CAPITAL *	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 30 JANUARY	+ RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1960-61 HIGH	1960-61 LOW	1959 HIGH	1959 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation	28/3	—9d.	11	9	7 16 0	34/9	25/6	33/3	23/3
400,000	2/-	Anti-Attrition Metal	1/3		NIL	4	NIL	1/6	0/9	1/7½	1/-
41,303,829	Stk. (£1)	Associated Electrical Industries	41/6		15	15	7 4 6	67/3	39/3	67/-	54/-
3,236,424	1	Birfield	57/-	+ 2/-	15‡	15	2 12 6	61/-	34/0	75/4½	46/-
4,795,000	1	Birmid Industries	72/-	—6d.	20	20D	5 11 0	72/9	56/-	75/6	46/9
5,630,344	Stk. (10/-)	Birmingham Small Arms	29/-	+ 3d.	17½QT	12½	4 0 0	45/6	27/7½	69/-	36/-
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	14/10½		5	5	6 12 3	17/4½	14/10½	17/6	15/-
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	17/4½		6	6	6 17 3	20/-	17/1½	20/1½	17/9
500,000	1	Bolton (Thos.) & Sons	41/3	+ 1/3	10	10	4 17 0	42/3	37/-	47/-	27/6
300,000	1	Ditto Pref. 5%	14/3		5	5	7 0 3	16/-	13/6	16/-	14/9
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6%	17/6	—3d.	6	6	6 17 3	21/1½	17/3	21/6	18/9
18,846,647	Stk. (£1)	British Insulated Callender's Cables	57/-	+ 6d.	13½	13½	4 14 9	61/-	47/6	61/-	45/1½
17,047,166	5/-	British Oxygen Co. Ltd., Ord.	27/6	—3d.	16	16	2 18 3	34/6	19/6	87/9	49/3
1,200,000	Stk. (5/-)	Canning (W.) & Co.	14/-		15 + 8½C	25 + *2½C‡	5 7 3	19/6	13/3	18/1½	12/3
60,484	1/-	Carr (Chas.)	1/1½	+ 1½d.	NIL	12½	—	2/3	1/-	2/10½	1/3
555,000	1	Clifford (Chas.) Ltd.	26/6		10	10	7 11 0	35/-	26/-	30/-	22/6
45,000	1	Ditto Cum. Pref. 6%	15/3		6	6	7 17 6	16/-	15/3	16/-	17/-
300,000	2/-	Coley Metals	3/9	+ 3d.	15	15	7 14 9	5/-	3/3	4/6	2/6
10,185,696	1	Cons. Zinc Corp.†	67/-	+ 6d.	20	15	5 19 6	80/-	60/6	77/3	57/9
5,399,056	1	Davy-Ashmore	138/-	—1/-	30‡	20	2 3 6	146/3	100/6	116/-	43/-
7,695,000	5/-	Delta Metal	20/3	+ 3d.	17½	31‡	4 6 6	28/-	18/7½	26/4½	11/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	47/6	—6d.	15	15	6 6 3	56/3	45/-	61/9	36/7½
1,155,000	1	Evered & Co.	43/6		10B	10φ	3 1 3	42/9	29/-	42/6	30/-
18,000,000	Stk. (£1)	General Electric Co.	31/9		10	10	6 6 0	47/6	29/3	50/6	30/-
1,500,000	Stk. (10/-)	General Refractories Ltd.	46/3	+ 1/3	20	20	4 6 6	51/6	40/-	47/-	31/4½
750,000	1/-	Glacier Metal Co. Ltd.	14/3		13	11½	4 11 3	15/9	11/1½	11/3	6/7½
2,500,000	5/-	Glynwed Tubes	23/4½	—7½d.	25¶	20	3 15 0	27/1½	17/7½	30/9	16/1½
7 228,065	10/-	Goodlass Wall & Lead Industries	36/6	—1/-	19L	16	3 17 0	41/6	33/4½	53/-	28/7½
696,780	10/-	Greenwood & Batley	25/9xcap	—3d.	30W	30	5 16 6	133/9	112/6	130/-	75/-
792,000	5/-	Harrison (B'ham) Ord.	12/7½		*20‡	*17½	3 19 3	15/4½	11/9	26/9	14/-
150,000	1	Ditto Cum. Pref. 7%	20/-	—3d.	7	7	7 0 0	20/-	19/3	19/6	19/4½
1,075,167	5/-	Heenan Group	11/6		13D	15	4 18 6P	12/6	10/-	19/6	7/4½
249,932,548	Stk. (£1)	Imperial Chemical Industries	71/-	+ 1/-	11½N	8	3 3 6	75/3	54/-	62/7½	33/1½
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	15/7½	+ 6d.	5	5	8 8 0	17/9	15/3	19/1½	15/6
22,184,044	**	International Nickel	111½	—1½	61.60	$1.50	2 10 0	113	85½	201½	154½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	14/-		5	5	7 2 9	16/6	14/6	17/6	14/9
6,000,000	1	Ditto Ord.	62/-	—6d.	12	12D	3 6 9	66/6	45/-	50/3	27/3
600,000	10/-	Keith, Blackman	19/9	+ 9d.	17½	17½E	8 17 3	32/6	17/9	32/-	25/-
320,000	4/-	London Aluminium	9/3	+ 4½d.	12	10	5 3 9	12/6	7/6	10/7½	5/3
765,012	1	McKechnie Bros. Ord.	57/-		17½F	15F	6 2 9	71/6	57/-	62/6	39/9
1,530,024	1	Ditto A. Ord.	53/9	—3d.	17½F	15F	6 10 3	69/3	55/-	65/6	38/9
1,108,268	5/-	Manganese Bronze & Brass	14/6		20⅝	20⅝	7 3 6	18/9	13/4½	19/-	13/6
50,628	e/-	Ditto (7½% N.C. Pref.)	6/-		7½	7½	7 10 0	6/6	6/-	7/9	5/9
21,745,110	Stk. (£1)	Metal Box	76/-	+ 1/-	12M	13B	2 14 6	83/-	55/9	80/-	44/7½
415,760	Stk. (2/-)	Metal Traders	7/-		50	50	14 5 9	10/4½	7/1½	13/6	8/4½
160,000	1	Mint (The) Birmingham	36/6		10	10	5 9 6	39/-	33/6	35/-	22/-
80,000	5	Ditto Pref. 6%	76/3		6	6	7 17 6	80/-	75/-	80/-	69/-
5,187 938	Stk. (£1)	Morgan Crucible A.	54/9	+ 9d.	13	12	4 15 0	62/3	47/6	52/6	30/-
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref.	16/-	—9d.	5½	5½	6 17 6	18/6	15/9	19/3	17/3
3,850,000	Stk. (£1)	Murex	40/7½	—1/4½d.	22½J	15	6 8 0	45/-	35/3	76/4½	41/-
585,000	5/-	Ratcliffs (Great Bridge) Ord.	16/6		10	10R	3 1 6	17/-	14/9		—
195,000	5/-	Ditto 8% Max. Ord.	5/-		8	—	8 0 0	5/3	5/-		—
1,064,880	10/-	Sanderson Kayser	34/3		35‡	25	5 2 3	40/3	27/7½	56/-	27/9
2,400,500	Stk. (5/-)	Serck	15/6	—3d.	12½	17½GD	4 0 9	25/-	15/3	26/-	12/-
7,232,069	Stk. (£1)	Stone-Platt Industries	56/-	—3d.	15	15	5 7 3	64/3	52/3	63/6	42/6
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	15/6		5½	5½	6 17 6	18/7½	15/3	18/9	15/10½
33,989,712	Stk. (£1)	Tube Investments Ord.	75/-	+ 1/3	14	20	3 14 9	95/9	66/3	138/-	71/7½
41,000,000	Stk. (£1)	Vickers	28/9		10	10	6 19 3	39/-	27/3	40/6	26/10½
750,000	Stk. (£1)	Ditto Pref. 5%	13/6	—6d.	5	5	7 8 3	17/6	14/-	17/3	14/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	20/-		*5	*5	7 8 9A	24/3	20/-	25/9	20/6
4,594,418	1	Ward (Thos. W.) Ord.	64/6		13½	25	4 2 6	86/-	64/-	167/6	83/-
7,109,424	Stk. (£1)	Westinghouse Brake	37/9	—6d.	11	10	5 16 6	59/9	37/9	60/7½	39/-
225,000	2/-	Wolverhampton Die-Casting	9/6		35	30	7 7 3	13/10½	8/3	13/1½	8/8½
591,000	5/-	Wolverhampton Metal	29/3	+ 1/-	32½	27½	5 11 0	39/6	23/9	34/3	21/6
156,930	2/6	Wright, Bindley & Gelt	3/7½	—1½d.	15	20‡	10 7 0	4/3	2/10½	4/3	2/6
124,140	1	Ditto Cum. Pref. 6%	13/6	+ 3d.	6	6	8 17 9	15/3	13/3	14/3	12/10½
150,000	1/-	Zinc Alloy Rust Proof	4/9	—1½d.	40	30	8 8 6	5/6	4/-	3/10½	2/9

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% capitalized issue. *The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units. φ and 6½% from Capital Profits B and 50% capitalized issue. G and 1½d. special distribution. F and special 5% tax free dividend H As forecast. ¶And 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. N Interim since increased. J and 75% capitalized issue. S and 40% capitalized issue. O calculated at 13¾%. Interim on smaller capital. P Calculated at 11¼%. Q also 1/- special tax free dividend and 50% capitalized issue. T Per £1 unit. W Before capital reorganization. Calculated at 15%.

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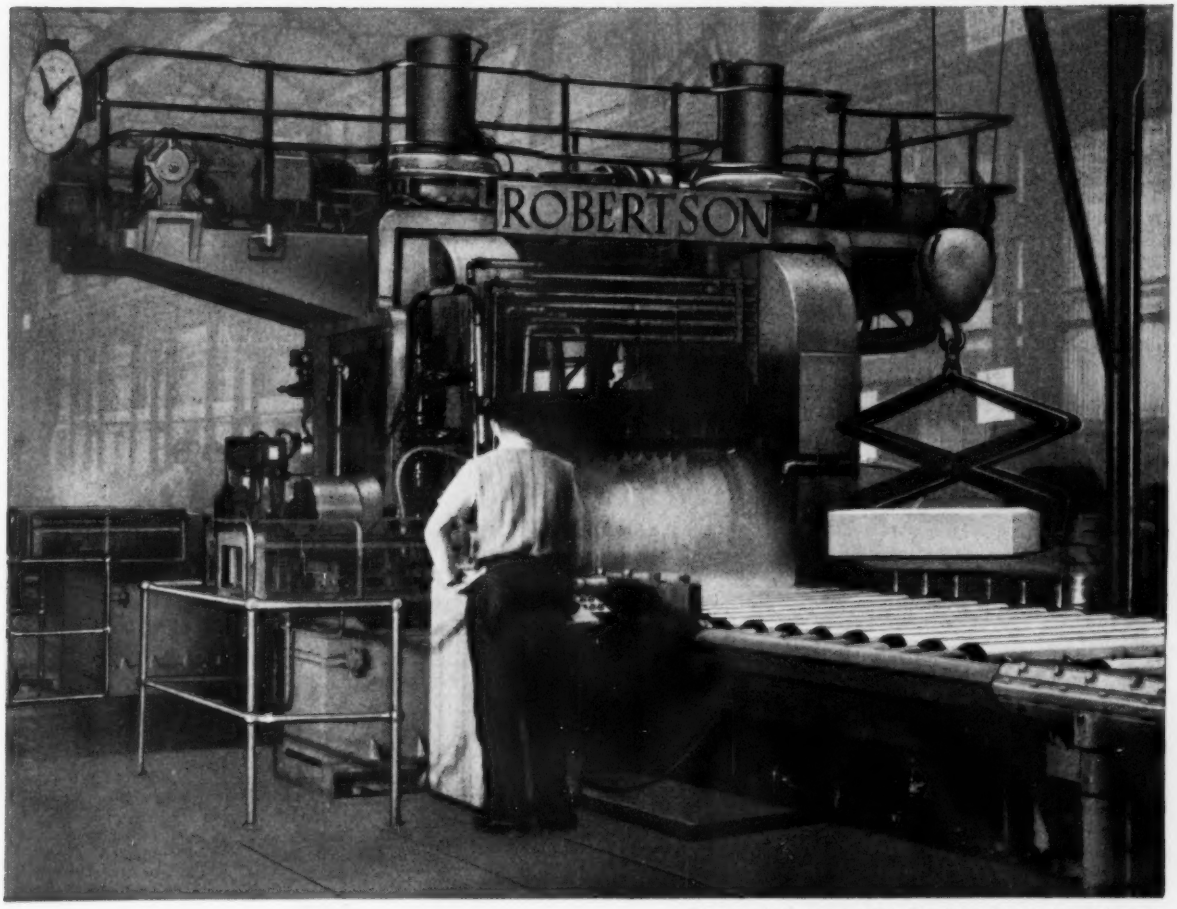

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